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Interpretive Bias in the Context of Life Stress and Depression: An Examination of Stress Generation and Diathesis-Stress Models

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A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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Abstract

Purpose: Researchers have recently demonstrated interest in interpretive bias, the tendency to interpret ambiguous information more negatively and/or less positively. The extent to which interpretive biases influence the occurrence of life stressors and potentially compound the negative effects of life stress in the development of depression is presently unknown. Hence, the purpose of this study was to investigate interpretive bias for ambiguous social information within the context of stress and depression. This study examined interpretive bias in the context of two theoretically and empirically supported models of depression – stress generation and diathesis-stress – to determine the mechanism through which interpretive bias influences depression. **Method:** Two hundred and seven young adult women participated in a two-wave prospective study. At Time 1, participants were asked to complete two measures of interpretive bias—the Scrambled Sentences Test and the Ambiguous Stories Task— as well as self-report questionnaires of their current depressive symptoms and depression symptom history. Five weeks later, participants were asked to complete a measure of their current depressive symptoms and a life events questionnaire. **Results:** Consistent with expectations, multiple indices of interpretive bias were directly predictive of Time 2 depression symptoms, over and above the effects of Time 1 symptoms. Some evidence was found for a role of interpretive bias in stress generation. In contrast to hypotheses, none of the interpretive bias variables interacted with life stress to predict depressive symptoms at follow-up (diathesis-stress model). **Conclusion:** Taken together, the findings suggest that a theoretically significant role exists for interpretive biases in depression vulnerability. Additionally, these findings offer initial evidence that individuals with a pre-existing cognitive vulnerability may be at

risk of contributing to the occurrence of stressful life events in their lives. Future research should examine interpretive biases in the context of interpersonal behaviours to determine the specific pathways from interpretation of an ambiguous situation to stress generation and/or depression.

Keywords: Interpretive Bias, Information Processing, Dysphoria, Depression, Stress, Life Events, Stress Generation, Diathesis-Stress

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Introduction

According to findings from the Global Burden of Disease study, Major Depressive Disorder (MDD) is the fourth leading cause of disease burden (e.g., disability and mortality) and the leading cause of non-fatal burden worldwide (Üstün, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004). In Canada, MDD affects more than 1.35 million people and accounts for $51 billion per year in direct treatment costs and indirect costs of disability claims and lost productivity (Lim, Jacobs, Ohinmaa, Schopflocher, & Dewa, 2008; Stephens & Joubert, 2001). By the year 2020, MDD is predicted to be second only to ischemic heart disease in terms of its overall cost to society (Keller & Boland, 1998; Lecrubier, 2001).

Major depression affects 2 to 4% of adults at any given moment (World Health Organization [WHO] International Consortium in Psychiatric Epidemiology, 2000) and between 12 and 25% of adults at some point in their lifetime (Kessler et al., 2005; Kessler, Zhao, Blazer, & Swartz, 1997; Lewinsohn, Rohde, Seeley, & Fischer, 1991; Patten et al., 2006). In Ontario alone, MDD affects 4.8% of the population over the age of 15 years, which translates into half a million people per year (Patten et al., 2006).

Women are twice as likely as men to experience a major depressive episode during their lifetime (Kessler et al., 2003; Patten, 2000). This gender difference in the prevalence and incidence rates of MDD emerges in early adolescence and remains significant until older adulthood (Akhtar-Danesh & Landeen, 2007; Kessler et al., 2003; Wade, Cairney, & Pevalin, 2002). Research has shown that the increased prevalence of MDD among women as compared to men is primarily the result of a greater number of first onsets of depression, and not the result of gender differences in duration of episodes

or recurrence of depression (Eaton et al., 1997; Hankin et al., 1998; Keller & Shapiro, 1981; Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993; Kovacs, 2001). Hence, it is critically important to understand the factors that may make women especially susceptible to the development of MDD.

Introduction to the Current Study and Conceptual Framework

The present study investigated one potential information processing risk factor for depression – interpretive bias – within the context of life stress in a sample of young women. Interpretive bias refers to the tendency to impose more negative interpretations on ambiguous information (e.g., Lawson, MacLeod, & Hammond, 2002). This cognitive tendency may play a causal role in the onset and maintenance of depression (Gotlib & Joormann, 2010; Mathews & MacLeod, 2005). A basic conceptual model outlining the primary variables of interest is depicted in Figure 1. In the proposed conceptual model, interpretive biases are based upon an individual's pre-existing vulnerabilities (e.g., genetic, neurobiological, temperamental, personality, cognitive, social) and previous life experiences (e.g., victimization, trauma), and are influenced by other information processing biases that the individual possesses (e.g., attention, memory, inhibition; A. Byrne & Eysenck, 1993; Chan, Goodwin, & Harmer, 2007; M. W. Eysenck, MacLeod, & Mathews, 1987; Gibb, Schofield, & Coles, 2009; Rijsdijk et al., 2009; Rusting, 1998). For example, both attention biases towards threat-relevant stimuli and memory biases for negative information would influence how someone interprets ambiguity (Ingram, Steidtmann, & Bistricky, 2008; White, Suway, Pine, Bar-Haim, & Fox, 2011; Wisco & Nolen-Hoeksema, 2011). To date, there has been limited research examining interpretive bias relative to other forms of information processing (e.g., attention, memory) in the

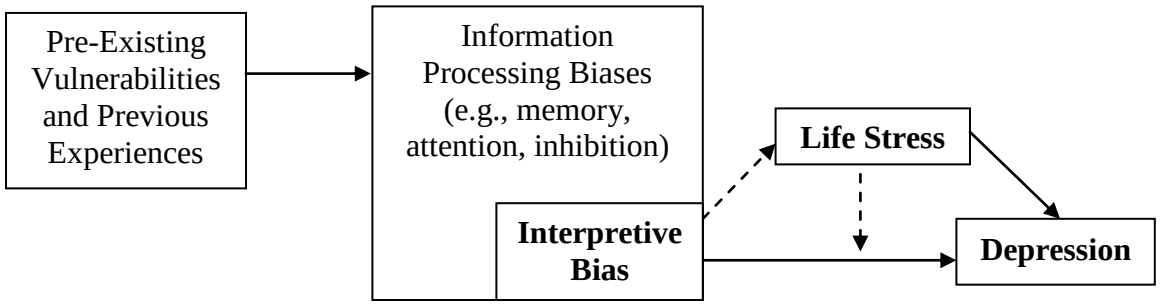

Figure 1. Conceptual research model situating interpretive bias within the context of life stress and depression. *Note. Bolded items are the variables of interest in the current investigation. Dashed lines indicate unique pathways investigated in the current study.*

context of depression, despite the fact that it may be an independent contributor to depression (Rude, Durham-Fowler, Baum, Rooney, & Maestas, 2010). At the same time, limited research has examined interpretive bias within the context of life stressors or life events – a well-known precipitant to the onset of dysphoria and depression (Hammen, 2005; Mazure, 1998). Previous research suggests that cognitive factors influence the occurrence of life stressors, indirectly contributing to depression, and also interact with stressful life experiences, directly causing depression (for reviews, see Hammen, 2005, 2006; Liu & Alloy, 2010). However, interpretive bias has never been investigated in relation to the occurrence of life stressors, and no one has examined how these variables interact or influence each other in the development of depression (Ingram et al., 2008). Negatively biased interpretations may contribute to the creation of stressful life circumstances directly, and have an indirect influence on depression through the generation of life stressors (stress generation/mediation model). Alternately, biased interpretation of ambiguous stimuli may cause depression directly in the context of life stressors (diathesis-stress/interactional/moderation model). Because of these unexplored questions, the main objective of this dissertation research was to examine interpretive bias, life stress, and depression, in a prospective design.

In the following sections, cognitive theories of depression are reviewed as an overall framework for understanding the role of information processing biases in depression. Subsequent to that, a brief summary of the existing research on information processing biases in depression, and a comprehensive review of the interpretive bias literature, are provided. After discussing the extant research on interpretive bias and depression, the role of stress in depression is examined. Two models incorporating stress

in depression—stress generation and diathesis-stress— are then discussed, and the hypothetical role of interpretive bias is situated within each of those proposed models. The final sections outline the rationale for the current study and provide a description of the specific study objectives and hypotheses.

Cognitive Theories of Depression

A vast body of research has tested the central tenets of cognitive theories of depression (e.g., Abramson, Metalsky, & Alloy, 1989; Abramson, Seligman, & Teasdale, 1978; Beck, 1967, 1976; Nolen-Hoeksema, 1991; Teasdale, 1983, 1988). According to these theories, various cognitive constructs, including perception, attention, recall, recognition, conceptualization, interpretation, and judgement, have an impact on the development, maintenance, and remission of depression (Ingram, Miranda, & Segal, 1998). Each model situates the role of cognition at a different point, but they all define cognitive vulnerability to depression as an internal, stable characteristic of an individual that places him or her at risk for developing depression following the occurrence of stressful life events (Ingram et al., 1998). Hence, these models are diathesis-stress models (i.e., interactional/moderation models), in that maladaptive cognition contributes to the development of depression only in the context of stressful life circumstances. In other words, the presence of both a cognitive vulnerability factor and life stressors is required to lead to depression.

Information processing bias and depression. Depression is characterized by cognition biases in information processing that are hypothesized to play a causal role in the onset and maintenance of disorder (Gotlib & Joormann, 2010; Mathews & MacLeod,

2005). Such biases[1] in attention, memory, interpretation, intrusive ideation, and inhibitory control for emotional information have been reported in both children and adults (for reviews, see Gotlib & Joormann, 2010; Leppänen, 2006; Mathews & MacLeod, 2005; Peckham, McHugh, & Otto, 2010; Yiend, 2010). Specifically, process-based models of depression have shown that there are significant attentional biases toward negative information and away from positive stimuli. However, stimuli may need to be self-referent or mood-congruent, and presentation durations may need to be longer ($\geq$ 1,000 ms) to allow for elaborative stimulus processing (Leppänen, 2006; Mathews & MacLeod, 2005; Mogg & Bradley, 2005; Peckham et al., 2010; Yiend, 2010). Furthermore, there are relatively consistent memory biases characteristic of depression. In particular, individuals with dysphoria or depression show enhanced memory for negative information compared to neutral and positive information, whereas non-dysphoric participants or healthy controls show enhanced memory for positive information compared to neutral and negative information (Bower, 1981; Bradley, Mogg, & Williams, 1995; Denny & Hunt, 1992; Derry & Kuiper, 1981; Ellwart, Rinck, & Becker, 2003).

While the majority of research has focused on the memory and attentional biases specific to depression, less empirical attention has been paid to interpretive biases (Gotlib & Joormann, 2010; Ingram et al., 2008; Mathews & MacLeod, 2005; Mineka, Rafaeli, & Yovel, 2009). However, many emotional and behavioural reactions are at least partially

[1] The term "bias" is used throughout this document to denote a tendency to process information in a way that favours a particular emotional valence or meaning. It does not refer to the accuracy or inaccuracy of those information processing tendencies in reflecting objective reality, or suggest a dysfunctional characteristic of the individual in possession of the particular bias. In fact, everyone has biases in some form or another. For example, individuals who are emotionally stable have positively biased interpretations in ambiguous social contexts (Hirsch & Mathews, 1997, 2000).

mediated by the perceptions, thoughts, and interpretations an individual generates concerning a given event or situation (Pyszczynski & Greenberg, 1992). In many ways, interpretation is one of several higher-level cognitive processes, along with judgement, decision-making, and reasoning, that influence a person's reactions to a given stimuli (Blanchette & Richards, 2010). At the same time, numerous everyday situations are ambiguous and can be interpreted in multiple ways. Ambiguity, for the purposes of this research, was defined as a situation involving a certain degree of uncertainty or vagueness that lends itself to multiple interpretations or meanings. Each possible interpretation or meaning may have a different emotional valence or consequence on affect, behaviour, or cognition. In the sensory domain, a slight touch on the skin could signal a mosquito bite (negative interpretation) or a strand of hair falling on the skin (benign interpretation; Blanchette & Richards, 2010). In the social realm, a friend who walks past you without acknowledging you might be understood to be ignoring you (negative interpretation) or preoccupied (benign interpretation; Holmes, Mathews, Dalgleish, & Mackintosh, 2006). In communication, a written or spoken sentence could be construed as sarcastically intended (negative interpretation) or taken at face value (benign interpretation; Blanchette & Richards, 2010). Examining interpretive bias in the context of depression may provide a way to understand how the integral cognitive process of interpretation relates to and/or plays a causal role in the development of a significant emotional disturbance. The existing literature on interpretive bias in depression is reviewed in the following sections.

Interpretive Bias and Depression

As stated earlier, interpretive bias generally refers to the tendency to impose more negative and/or less positive/benign interpretations on ambiguous stimuli, situations, and events (e.g., Lawson et al., 2002; Williams, Watts, MacLeod, & Mathews, 1997). Cognitive theories of depression would suggest that individuals vulnerable to depression or experiencing a depressive mood state should show an increased tendency to impose negative interpretations on ambiguous information due to underlying negative cognitive structures that influence information processing (e.g., Beck, 1967, 1987). In fact, previous research has suggested that depressed mood can influence how people interpret events, resulting in selective attention to negative aspects of social situations (Dodge, 1993). Despite this theoretical claim, research on interpretive bias has been somewhat mixed with respect to whether or not an interpretive bias exists in dysphoria and depression. Researchers have used various methodologies and paradigms to determine if and how interpretive biases relate to depression and dysphoric mood states.

Several studies have found evidence that depression is characterized by the presence of an interpretive bias. In their seminal work, Butler and Mathews (1983) presented participants with ambiguous written scenarios and asked them to rank order three interpretations in the order that they would most likely come to mind in a similar situation. Compared to non-depressed control participants, patients with clinical depression demonstrated a tendency to rank negative response options as more likely to come to mind. Other studies using questionnaire-based methods requiring participants to choose between alternative interpretations of ambiguous scenarios have yielded similar results in adults with clinical depression and elevated symptoms of depression (Nunn,

Mathews, & Trower, 1997; Voncken, Bögels, & Peeters, 2007). In children, similar methodologies have been used, including ambiguous story cards (Dineen & Hadwin, 2004) and ambiguous scenarios (Eley et al., 2008) with forced-choice interpretation options. These studies have found further evidence for an association between negative interpretations of scenarios and stories, and depressive symptoms, in children.

Other studies have applied homonym paradigms borrowed from the anxiety disorders literature. For example, Mogg and colleagues (2006) used a homophone task that required respondents to write down a list of orally presented words that included homophones (each with a negative and a non-negative meaning; e.g., *die/dye*, *weak/week*) and neutral filler words. Compared to control participants, outpatients with clinical depression made more negative interpretations on the homophone task (Mogg et al., 2006). In contrast, other studies have found no association between self-reported depressive symptoms and negative interpretations using a similar homophone task (Pury, 2002). Using a similar methodology adapted for young children, Eley and colleagues (2008) asked participants to listen to a homophone word (e.g., *mug, leaves, patient*) and then provide a sentence that used that word which was recorded and coded. Increased depressive symptoms were significantly related to greater numbers of negative interpretations of ambiguous homophones in 8-year-olds, even after controlling for anxiety symptoms (Eley et al., 2008). Another study used a homograph task in which participants were asked to generate an interpretation of an ambiguous single word, such as "break" (*broken/rest*) or "sentence" (*prison/phrase*). In this case, no differences were found in the frequency of positive or negative interpretations generated by high dysphoric

and low dysphoric students (Holmes, Lang, Moulds, & Steele, 2008). Hence, homonym paradigms are supported by evidence in clinical and youth, but not analogue, samples.

One disadvantage of these formats of interpretive bias assessments is that they rely on participants' self-report, which raises concerns about possible response biases and demand characteristics (Lawson & MacLeod, 1999; MacLeod, 1993; MacLeod & Mathews, 1991; Mathews & MacLeod, 1994). For instance, individuals with dysphoria or depression may process both neutral/benign and negative interpretations of ambiguous material, but endorse or select the latter more often than control participants due to a reporting bias rather than an interpretive bias (Mogg et al., 2006; Wisco, 2009). This possibility was supported in a study that examined depressed participants' sucrose taste sensitivity threshold using signal detection methods (Potts, Bennett, Kennedy, & Vaccarino, 1997). Potts and colleagues (1997) found that response bias rather than true differences in taste sensitivity were the cause of higher thresholds in individuals with depression. Additionally, dysphoric participants generate significantly more negative interpretations than do non-dysphoric participants, and are more likely to select a negative interpretation from their generated list, even though both groups are able to generate an equal number of possible interpretations for a given ambiguous situation (Wisco & Nolen-Hoeksema, 2010, 2011). Self-report measures are also influenced by participants' previous experiences and may be skewed because of anchoring and overestimation biases (Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002).

To overcome limitations with these early methods of assessment, researchers have developed alternate techniques and methodologies to assess interpretation that do not require participants to endorse alternative response options. One information processing

measure that has been frequently used to assess interpretive bias is the Scrambled Sentences Task (SST; Wenzlaff, 1988, 1993). In this task, participants are asked to construct a grammatically correct sentence using five out of the six words presented to them in a nonsensical manner (e.g., *good feel very bad I usually*). Each sentence can be unscrambled to form a negative sentence (e.g., *I usually feel very bad*) or positive/benign sentence (e.g., *I usually feel very good*). Negative interpretive bias is inferred based on the number of sentences a participant unscrambles using the negative solution, as a proportion of the total number of sentence unscrambled. As would be expected, currently-depressed individuals constructed a greater proportion of negative sentences than do never-depressed or previously-depressed individuals (Hedlund & Rude, 1995). Wenzlaff and colleagues (Hedlund & Rude, 1995; Rude, Covich, Jarrold, Hedlund, & Zentner, 2001; Wenzlaff & Bates, 1998) hypothesized that biased information processing patterns remain active in previously-depressed and currently dysphoric individuals, but cannot be easily accessed using self-report measures because these individuals suppress negative thoughts using mental control. Increasing the cognitive load (e.g., rehearsing a series of numbers, counting aloud during the task) is believed to make volitional negative thought suppression more difficult, rendering vulnerable participants more likely to unscramble sentences using the negative solution. Indeed, dysphoric individuals were more likely than non-dysphoric individuals to unscramble sentences in a negative way, but only under cognitive load (Wenzlaff & Bates, 1998). Interestingly, individuals with a history of major depression also tended to construct more negative sentences than did never-depressed persons, providing further evidence that interpretive bias may linger

even once depressive symptoms abate (Hedlund & Rude, 1995; Rude et al., 2001; Van der Does, 2005; Watkins & Moulds, 2007).

Interpretation biases in depression have also been investigated using priming paradigms. In a priming task, participants view an ambiguous prime stimulus and then an unambiguous semantically related stimulus. This experimental technique assumes that a particular meaning is activated in the participant's mind when the ambiguous prime stimuli are presented. Interpretive bias is inferred by the degree to which the prime facilitates the processing of subsequent target words related to either possible prime meaning. By measuring the response latency to read a negative or neutral associated unambiguous stimulus, interpretive bias is calculated. In one of the first studies to use this approach, Lawson and MacLeod (1999) compared participants who were high versus low in depressive symptoms and who had been primed using a negative or positive Velten mood induction procedure. These researchers presented individuals with ambiguous sentences (e.g., *The doctor examined little Emily's growth*), followed by either a negative target word (e.g., *tumour*) or a neutral target word (e.g., *height*). Participants were asked to read aloud the sentence and the word that followed as quickly and as accurately as possible. In the case of a negative interpretation, response latencies for the negative target word were expected to be faster than response latencies for the benign/neutral target words, suggesting that the negative words were primed by the sentence. Unfortunately, support was not found for this hypothesis. No evidence of naming facilitation for negative target words was shown in the group of participants with elevated depressive symptoms, whereas the group with fewer symptoms of depression demonstrated faster reaction times (facilitation) in naming negative target words. Hence, contrary to

expectations, participants with higher depressive symptomatology actually showed a *decreased* tendency to attach a negative interpretation to ambiguous written stimuli when compared to participants with lower depressive symptoms, and this effect held irrespective of the mood manipulation condition (Lawson & MacLeod, 1999).

A second study replicated and extended Lawson and MacLeod's (1999) semantic priming task, but used a video and musical negative mood induction procedure (Bisson & Sears, 2007). Instead of requiring participants to read the target words aloud, respondents were asked to listen to the prime sentences presented auditorily, and then were asked to make a lexical decision about whether the target was a word or non-word (yes/no response) by pressing one of two buttons. Response latencies were measured from the initial visual presentation of the target word until the participant's button response. Bisson and Sears (2007) found no response latency evidence for an interpretive bias, and no differences in semantic priming effects between dysphoric and non-dysphoric participants. In other words, dysphoric individuals were no more likely than non-dysphoric individuals to impose a negative interpretation, and were no more and no less likely to consider a positive interpretation, of the ambiguous prime sentences (Studies 1A and 1B) even following a negative mood induction procedure (Study 2).

In a further modification of the priming paradigm, Mogg and colleagues (2006) used a sample of clinically depressed adult outpatients and compared them to matched non-depressed control participants. In their priming task, participants were initially presented with a negative (e.g., *death*) or benign/positive (e.g., *marriage*) word before the ambiguous sentence (e.g., *Carol felt emotionally throughout the service*). The response duration for participants to read aloud a continuation sentence was recorded. The final

sentence was a logical continuation of the ambiguous sentence, and was either negative (e.g., *Funerals always made her cry*) or benign/positive (e.g., *Weddings always made her cry*). The study authors hypothesized that faster reading latency for the negative continuation sentences would indicate a negative interpretive bias (i.e., facilitated processing of negative endings primed by the initial word and ambiguous sentence). Once more, the study failed to find support for a negative interpretive bias in depressed outpatients using this priming task (Mogg et al., 2006). Patients with depression did not differ from control participants in their reaction time responses to continuation sentences, irrespective of the prime cue word type, other than being slower across all conditions (benign, negative, and no cue).

Taken together, these results suggest that there may not be a depression-related negative interpretive bias measurable in response times to ambiguous sentences. However, these null findings may be due to the type of ambiguous stimuli used in the studies. Because the negative self-schema is integral to depression (Dozois & Beck, 2008), self-referent content may be necessary for appropriately exploring depressive cognitions, especially interpretive biases (Wisco, 2009). In fact, individuals with depression show stronger interpretive biases when presented with self-referent material than when presented with general or other-referent material (Dineen & Hadwin, 2004; Hertel & El-Messidi, 2006; Wisco & Nolen-Hoeksema, 2010; see Wisco, 2009 for a review).

Bearing this criticism in mind, researchers have further attempted to examine response latencies as an index of interpretive bias using self-referent stimuli (Dearing & Gotlib, 2009; Sears, Bisson, & Nielsen, 2011). One sample that is known to be

particularly at-risk for developing depression is the children of mothers who themselves have been depressed (Goodman, 2007; Goodman & Gotlib, 1999). Previous research has shown that children of mothers with depression display depressotypic information processing and cognitive vulnerabilities when compared to daughters of never-depressed mothers (Hammen, 1988; Hammen & Goodman-Brown, 1990; Ingram & Ritter, 2000; Jaenicke et al., 1987; Murray, Woolgar, Cooper, & Hipwell, 2001; Taylor & Ingram, 1999). Dearing and Gotlib (2009) were the first researchers to examine interpretive bias comparing 10- to 14-year-old never-disordered daughters of mothers with histories of recurrent major depression (high risk) and daughters of never-disordered mothers (low risk). These researchers compared interpretations of ambiguous stories using a priming paradigm in which participants were presented with three sentence self-referential scenarios (e.g., *In math class, you are given time to work on an extra credit problem. You read the problem carefully but can't figure out how to start it, so you decide to ask your teacher for help. As you ask for help, you're sure your teacher will think you are* _____) that remained ambiguous until the last word of the third sentence. The final word was either negative (e.g., *dumb*), benign (e.g., *hardworking*), or grammatically impossible (e.g., *death*), and participants were asked to indicate if the word was a grammatically possible ending to the story (yes/no response). In the case of a negative interpretation bias, response latencies for the negative words were expected to be faster than response latencies for the benign words or grammatically impossible story endings, suggestive that the negative interpretations were primed by the scenarios. High risk daughters were more likely than low risk daughters to interpret ambiguous stories negatively (i.e., showed faster reaction times for negative endings; Dearing & Gotlib,

2009). This study provides some support that interpretive biases may be present prior to the onset of depressive disorders in at-risk populations, suggesting that it may be a latent risk factor. However, this study did not examine interpretive bias in currently dysphoric or depressed samples.

Sears and colleagues (2011) utilized self-referent stimuli in a semantic relatedness task. Similar to their earlier study (Bisson & Sears, 2007), participants were asked to listen to ambiguous sentences (e.g., *My boyfriend said that I am unlike his past girlfriends*), and required to respond to target words that were either related to negative (*jealous*), positive (*attractive*), or neutral (*relationship*) interpretations of the sentence or were unrelated (*democracy*). Respondents were asked to indicate whether or not the target word was related to the prime sentence (yes/no response). It was expected that a negative interpretive bias would be revealed as faster response latencies and lower error rates for target words related to negative interpretations of the prime sentences. Contrary to hypotheses, dysphoric participants did not show faster reaction times for negative target words relative to non-dysphoric participants, and instead showed consistently slower reaction times across all targets (Sears et al., 2011). The authors further examined participants' error rates for failing to detect that the ambiguous prime sentence and target word were related. Dysphoric participants were more likely than non-dysphoric participants to miss targets related to positive interpretations and less likely to miss targets related to negative interpretation. These findings suggest that dysphoria is related to an increased tendency to interpret the ambiguous primes in a negative manner and decreased tendency to interpret the ambiguous primes in a positive manner (Sears et al., 2011).

In summary, it remains unclear whether interpretive bias can be assessed reliably in depression. Studies using ambiguous scenarios with forced-choice options or homonym paradigms, while demonstrating the most consistent support, also seem most open to response bias (Butler & Mathews, 1983; Dineen & Hadwin, 2004; Eley et al., 2008; Mogg et al., 2006; Nunn et al., 1997; Voncken et al., 2007; for exceptions see Holmes et al., 2008; Pury, 2002). The SST has had consistent success in revealing differences in clinical and non-clinical samples, yet has not been widely adopted beyond certain research groups (Hedlund & Rude, 1995; Rude et al., 2001; Wenzlaff & Bates, 1998). Response latency indices have shown no support for an interpretive bias in dysphoria and depression using non-self-referent stimuli (Bisson & Sears, 2007; Lawson & MacLeod, 1999; Mogg et al., 2006), but more promising results are obtained when self-referent stimuli are utilized (Dearing & Gotlib, 2009; Sears et al., 2011). However, further research is required to determine if and how interpretive bias may be related to stress and changes in mood state over time.

Interpretive bias as a causal factor in depression. Aside from the equivocal nature of the cross-sectional research that has attempted to characterize interpretive bias in depression, there are theoretical reasons to predict that interpretive biases may lead to a worsening of emotional states, particularly when repeated over time (e.g., Beck & Clark, 1991). Specifically, cognitive theory of depression posits that activation of enduring latent cognitive template or representation of the self, referred to as the self-schema, leads to negative information processing biases (e.g., attention, memory, interpretation, inhibition) which may initiate and/or maintain a dysphoric mood state, leading to greater negative thinking and worsening depressed mood (Beck, Rush, Shaw, & Emery, 1979; D.

A. Clark, Beck, & Alford, 1999; Nolen-Hoeksema, 1991). Over time, this reciprocal exchange of negative information processing and the accompanying negative mood state lead to the downward spiral of depression.

According to cognitive theories, stressful life events are the trigger that activates these latent cognitive vulnerabilities, in a diathesis-stress relationship (Abramson et al., 1989, 1978; Beck, 1967, 1976; Nolen-Hoeksema, 1991; Teasdale, 1983, 1988). However, the criteria for what constitutes a stressful life event may shift over the course of an individual's life. For example, vulnerable individuals may become sensitized to stress over time, such that less life stress is required to trigger depressogenic cognitive patterns and the accompanying increases in dysphoria and onset of a depressive episode (Monroe & Harkness, 2005). This especially may be the case in instances where major life stressors occurred during childhood (Espejo et al., 2007; Hammen, Henry, & Daley, 2000; Harkness, Bruce, & Lumley, 2006). A lowered threshold could lead to more frequent activation of negative information processing biases (i.e., interpretive bias) in the face of daily experiences (e.g., not getting an expected raise at work, being stuck in a traffic jam) and their accompanying negative mood state. Hence, major life events may not be required to trigger negative interpretive bias in the downward spiral to depression; daily experiences may be sufficient in and of themselves.

In addition, vulnerable individuals may also perceive a wider range of events as stressful, leading to increased numbers of potential triggers for depressogenic information processing (Ingram et al., 1998). Repeated activation of negative interpretations of ambiguous events may lead individuals to develop a well-practiced tendency to view ambiguity in a negative light, such that they then perceive nonthreatening events as

stressful. When repeated on a day-to-day basis, these misperceptions help to self-perpetuate the negative interpretations (Hill, Lewicki, Czyzewska, & Boss, 1989; Hill, Lewicki, & Neubauer, 1991; Lewicki, Hill, & Sasaki, 1989) and could lead to dysphoric emotional reactions and/or trigger other depressogenic cognitive vulnerabilities (e.g., rumination) and the onset of depression.

Hence, over brief and longer duration longitudinal designs, one might find that interpretive bias predicts increases in depressive symptoms and/or the onset of a major depressive episode. For example, during the course of an experiment, dysphoric participants experienced increased negative mood in response to generating and selecting interpretations to ambiguity for self-referent situations (Wisco & Nolen-Hoeksema, 2010, 2011). Similarly, evidence shows that interpretive bias, as assessed by the SST, predicts increases in depressive symptoms over a four to six week period, controlling for past and concurrent depression (Rude et al., 2002). Furthermore, interpretive bias is predictive of the onset of clinically significant major depressive episodes over an 18 to 28 month follow-up period, controlling for baseline self-reported depressive symptoms and worst lifetime symptoms (Rude, Valdez, Odom, & Ebrahimi, 2003; Rude et al., 2010). Hence, there is some evidence that interpretive bias predicts negative shifts in mood and the onset of clinically significant episodes of depressive episodes over varying durations.

Although the results of such prospective studies are encouraging, they are not definitive regarding the causal status of interpretive bias in the mediation of depression vulnerability. In theory, it is possible that both the information processing tendency manifested as interpretive bias and emotional vulnerability to depression may represent independent correlates of another third factor (such as neuroticism or negative affectivity;

Mathews & MacLeod, 2005). Such an association would provide the impression that interpretive bias has predictive validity, without necessarily causal significance. A more powerful test as to whether or not interpretive bias plays a causal role in vulnerability to depression comes from experimental studies that directly manipulate interpretations and then observe the impact of such manipulations on emotion (for reviews, see Mathews & MacLeod, 1994, 2005). As an alternate paradigm for exploring interpretive bias, some researchers have sought to experimentally manipulate and test whether particular forms of interpretive bias can be trained. In these cognitive bias modification of interpretation (CBM-I) paradigms, participants are intentionally trained to limit interpretations of ambiguous information in a particular direction (positive or negative; Grey & Mathews, 2000; Mathews & Mackintosh, 2000; Tran, Hertel, & Joormann, 2011; for reviews, see Hallion & Ruscio, 2011; Field & Lester, 2010). With sufficient practice, it is believed that habitual biases in interpretation will generalize to novel ambiguous information (Hill et al., 1989, see 1991; Lewicki et al., 1989 for details of the self-perpetuation of interpretation biases). Indeed, several studies of positive interpretation training have been able to increase positive affect and increase subsequent positive interpretations of ambiguity in adults and adolescents (Holmes, Lang, & Shah, 2009; Holmes et al., 2006; Lothmann, Holmes, Chan, & Lau, 2011; Salemink & Wiers, 2011; Standage, Ashwin, & Fox, 2010; Tran et al., 2011), with some preliminary evidence emerging in child samples (Muris, Huijding, Mayer, & Hameetman, 2008; Muris, Huijding, Mayer, Remmerswaal, & Vreden, 2009). The results of these studies suggest that interpretive biases are directly associated with mood state and are modifiable. Interestingly, many of these studies use the SST as an index of interpretive bias (e.g., Holmes et al., 2009; Standage et al., 2010).

Therapeutically, repeated sessions of CBM-I have also shown promise at helping to improve mood, interpretive bias, and mental health in persons with current clinical depression (Blackwell & Holmes, 2010).

Interpretive bias and the role of stress. The prospective and CBM-I studies suggest that interpretive bias may be a causal vulnerability factor for depression. Beyond this inference, there is also suggestion of a potential role of environmental context in helping to explain how interpretive bias may contribute to the development of dysphoria and depression. For example, there is evidence from CBM-I studies that the modification of interpretive bias can also lead to attenuated emotional reactivity when experiencing subsequent stressors. Specifically, in cases where participants were trained to interpret ambiguity in a nonthreatening or positive way, there is evidence of attenuated emotional reactions following subsequent video stressors or imagined social situations (Lester, Mathews, Davison, Burgess, & Yiend, 2011; Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Wilson, MacLeod, Mathews, & Rutherford, 2006). Additionally, there is evidence that training positive biases using imagery buffered the impact of a negative mood induction procedure in a nonclinical sample (Holmes et al., 2009). These CBM-I studies provide support for a protective influence of positive interpretations in preventing or alleviating the expected negative effects of stressors. On the other hand, the tendency to interpret ambiguous homonyms in a more negative manner predicted later dysphoric reactions in response to school examination stress one month later (Pury, 2002). Hence, there may be an interactional/moderation role (diathesis-stress model) for interpretive bias in the context of stress. More specifically, negative interpretive bias in the context of stress may contribute to dysphoric reactions. Likewise, the absence of negative

interpretive bias may attenuate or buffer against stress's adverse consequences on mood. This hypothesis is consistent with the previously described cognitive diathesis-stress theory (interactional/moderation models), which proposes that individuals with particular cognitive tendencies will interpret and react to stressful life events in ways which increase the likelihood of developing depression (e.g., Abramson et al., 1989; Beck, 1987).

At the same time, an individual's exposure to stressors does not appear to be completely due to chance or fate (Hammen, 2006). Rather than viewing individuals as passive recipients of life experiences, one can view them as active participants in selecting or avoiding specific situations or environments, and evoking certain responses from others around them (Buss, 1987; Hammen, 1991; Magnus, Diener, Fujita, & Pavot, 1993). Stress generation theory (mediation model) suggests that vulnerable individuals act in ways that inadvertently cause more stressful life experiences, and further worsen their mood (Hammen, 1991; see also Alloy, Liu, & Bender, 2010; Hammen, 2006; Liu & Alloy, 2010, for reviews). Hence, there may be a place for interpretive bias to act as the vulnerability factor that influences the generation of and/or interacts with life stress to predict depression. In the following sections, prior research on the relationship between stress and depression is reviewed, with particular focus on the role of cognitive vulnerabilities in stress generation and diathesis-stress models. Following this overview, the objectives of the current study are highlighted which situate interpretive bias as the cognitive vulnerability factor under examination.

Stress and Depression

The association between stressful life events and depression has been a focus of

research for some time. Depression is known to be a frequent outcome of exposure to stress (Brown & Harris, 1978; Hammen, 2005; Kessler, 1997); however, this relationship is not always consistent (e.g., Rutter, 2000). The vast majority of individuals with depression report having experienced acute stressors immediately prior to the onset of their depressive episode (Horesh, Klomek, & Apter, 2008; Mazure, 1998; Stroud, Davila, & Moyer, 2008). In particular, women report significantly more life events prior to the onset of depression than do men (Harkness et al., 2010). Nonetheless, not all individuals who experience a stressful life event go on to develop a depression, suggesting that there may be individual vulnerability factors (e.g., temperamental or personality characteristics, genetic factors, depressogenic cognitive styles) which make some people more susceptible to the negative impact of stressors. In fact, only 20% to 50% of individuals who experience a significant negative life event develop clinically significant levels of depression (Goodyer, Tamplin, Herbert, & Altham, 2000; Lewinsohn et al., 1994). Furthermore, as stress generation theory suggests, individuals may be at increased risk of contributing to and/or causing the occurrence of stressors in their lives due to similar pre-existing vulnerability factors (Hammen, 1991, 2005, 2006). In particular, there is evidence that women experience higher levels of stressful life events, especially in the interpersonal area, than men (Hankin, Mermelstein, & Roesch, 2007; Kendler, Thornton, & Prescott, 2001; Shih, Eberhart, Hammen, & Brennan, 2006). Thus, stress and depression (or depressogenic vulnerabilities) likely share a transactional, bidirectional relation (Alloy et al., 2010). Stress may be a strongly implicated factor in the development of depression; however, it is neither necessary nor sufficient to cause depression without some other form of underlying vulnerability (Hankin & Abela, 2005).

In some instances, a diathesis-stress relationship exists wherein pre-existing vulnerabilities interact with the occurrence of stressors to produce depression (interactional/moderation model). In other cases, pre-existing vulnerabilities may lead to the generation of stressors, which in turn predict depression (stress generation/mediation model). Examining the possible convergence of these perspectives may provide insight into how interpretive bias leads to dysphoria and depression in women over time.

Stress Generation and Depression

The stress-generation hypothesis was originally investigated in relation to clinical depression, and deemed a potential mechanism for explaining the maintenance and recurrence of the disorder (Hammen, 1991, 1992). Compared to individuals without a psychiatric history, or those who experienced a first onset of the disorder, individuals with a history of depression reported a higher frequency and/or severity of life events that were (at least partially) *dependent* or contingent on their own behaviour (e.g., fired from job, break up with romantic partner). At the same time, the frequency and severity of events which were *independent*, fateful or non-contingent, (e.g., grandparent died, earthquake) did not differ among individuals with a history, in their first episode or without a history of depression (Brostedt & Pedersen, 2003; Chun, Cronkite, & Moos, 2004; Cui & Vaillant, 1997; Daley et al., 1997; Hammen, 1991; Harkness, Monroe, Simons, & Thase, 1999; Holahan, Moos, Holahan, Brennan, & Schutte, 2005; Rudolph et al., 2000; Williamson, Birmaher, Anderson, Al-Shabbout, & Ryan, 1995). This result has been replicated in samples of both adults (Chun et al., 2004; Hammen, 1991; Harkness et al., 1999; Potthoff, Holahan, & Joiner, 1995) and youth (Daley et al., 1997; Davila, Hammen, Burge, Paley, & Daley, 1995; Rudolph et al., 2000; Rudolph, Flynn, Abaied,

Groot, & Thompson, 2009; Williamson et al., 1995) with diagnosed depression or interview-rated subclinical levels of depressive symptoms.

More recently, researchers have begun to distinguish between stress generation that results from the spectrum of depressive symptoms or syndrome versus that which results from other factors, such as genetics, personality factors, life stressors, interpersonal behaviour patterns, and cognitive vulnerabilities (for reviews, see Alloy et al., 2010; Hammen, 2006; Liu & Alloy, 2010). For example, it has been well-established that genetic factors play a significant aetiological role in exposure to dependent life events, but not independent life events (Bemmels, Burt, Legrand, Iacono, & McGue, 2008; Kendler, Karkowski, & Prescott, 1999; Kendler & Karkowski-Shuman, 1997; Rijsdijk et al., 2001). Research also suggests that a large proportion of the genetic association between dependent stressors and risk of depression may be mediated by enduring personality characteristics, such as neuroticism, extraversion, and openness to experiences (Billig, Hershberger, Iacono, & McGue, 1996; Saudino, Pedersen, Lichtenstein, McClearn, & Plomin, 1997). Past experiences with stressful experiences, such as chronic stressors or childhood maltreatment, also are implicated in the generation of subsequent life events (Daley et al., 1997; Hammen, Kim, Eberhart, & Brennan, 2009; Harkness et al., 2006). At the same time, there are several interpersonal factors that are predictive of stress generation, including insecure attachment styles, excessive reassurance seeking, and sociotropy/dependency (Bottonari, Roberts, Kelly, Kashdan, & Ciesla, 2007; Eberhart & Hammen, 2009; Hankin, Kassel, & Abela, 2005; Nelson, Hammen, Daley, Burge, & Davila, 2001; Potthoff et al., 1995; Shahar, Joiner, Zuroff, & Blatt, 2004; Shahar & Priel, 2003; Shih, 2006; Shih, Abela, & Starrs, 2009; Shih &

Auerbach, 2010).

Integrating this broadened application of the stress-generation hypothesis with the genetic, personality, cognitive, and interpersonal theories yields a new framework whereby individuals may be not only more reactive to stressors, but may also play a role in creating those very stressors through their thoughts, behaviours, interpersonal interactions, and situations they select (Caspi & Shiner, 2006; Kendler & Karkowski-Shuman, 1997; Shih et al., 2009; Simons, Angell, Monroe, & Thase, 1993). Individuals with a pre-existing vulnerability to depression may be generating the stressors which will activate their vulnerability in a diathesis-stress context (e.g., Hankin & Abramson, 2001; Hankin, Kassel, et al., 2005; Shih, 2006). Individuals with a pre-existing cognitive vulnerability may be at risk of causing stressful life events in their lives and may be more reactive to those events when they do occur (Shih & Auerbach, 2010).

Stress generation and cognitive vulnerabilities to depression. Notwithstanding the substantial evidence supporting the stress generation effect based on depressive symptoms/syndrome, genetics, personality, and interpersonal factors, researchers have now begun to explore what specific cognitive vulnerability factors might contribute to the generation of stressful life events. Numerous cognitive variables have been suggested as potential mechanisms explaining the generation of stress in depression-prone individuals. In this context, a handful of studies have examined the main cognitive factors proposed by cognitive theories of depression (Abramson et al., 1978; Beck, 1987; Nolen-Hoeksema, 1991). To date, however, no one has examined information processing biases, such as interpretive bias, in the context of stress generation.

In the earliest of the studies exploring cognitive predictors of stress generation, Simons and colleagues (1993) examined the cross-sectional relationships among two cognitive vulnerability factors – dysfunctional attitudes from Beck's cognitive model (1987) and attributional/inferential styles from hopelessness theory (Abramson et al., 1978) – and life events as assessed by both subjective self-report and objective interview-based methods in a sample of participants experiencing clinical depression. Interpersonal and achievement attributions predicted a greater number of interview-derived dependent life events in the year prior to the onset of the index depressive episode, particularly for those individuals experiencing their first onset. Dysfunctional attitudes in the domain of achievement were significant predictors of self-reported achievement events, controlling for current self-reported depressive symptoms and objective stress. This relationship did not hold for interpersonal events or when using attributional style as a predictor.

Prospective studies have also attempted to examine the role of various cognitive vulnerabilities in the generation of life stress. Using a high-risk sample of children of mood-disordered parents, Shih and colleagues (2009) found that children's "weakest link" score on inferential style (i.e., children's highest standardized subscale score or most depressogenic inferential style) predicted dependent interpersonal stress over a one year follow-up (as assessed by a combination of self-report and interview-based measures). In this study, "weakest link" inferential style did not predict level of independent stress, consistent with predictions of stress generation theory. In contrast, using a college sample Gibb and colleagues (2006) found no evidence that inferential style prospectively predicted subsequent stress over a six-week period. Thus, although

there is some support for the role of attributional/inferential styles in stress generation, the prospective research findings are mixed.

Studies examining rumination as the cognitive vulnerability factor of interest have found more consistent support for a stress generation effect. In a multi-wave study of undergraduate students, Flynn and colleagues (2010) explored the role of depressive rumination in the generation of life stress, and their prospective contribution to depressive symptoms over a 27-month period. Depressive rumination was defined as the tendency to passively and repetitively focus on the experience of negative moods, as well as their causes and consequences (Nolen-Hoeksema, 1991; Nolen-Hoeksema & Morrow, 1991). Consistent with the stress generation hypothesis, depressive rumination was predictive of dependent interpersonal stress and dependent achievement stress, but not independent life events. A similar multi-wave study with adolescents found that higher levels of rumination were associated with a greater number of negative events in the future, and that rumination levels moderated the impact of negative events on the development of subsequent depressive symptoms and episodes (i.e., diathesis-stress model; Abela & Hankin, 2011).

Studies using composite measures of cognitive vulnerabilities have also explored stress generational models in undergraduates and adolescents. One study, which utilized an interview-based measure of life events, found that undergraduate women with a more negative cognitive style (a composite measure combining attributional/inferential style and dysfunctional attitudes) experienced a greater number of dependent and interpersonal life events over a 6-month period than did women with a more positive cognitive style, or men with any form of cognitive style (Safford, Alloy, Abramson, & Crossfield, 2007).

Cognitive style was not related to the occurrence of independent or achievement-related life events. This pattern of relationships remained consistent, even when participants with current or past depression diagnoses were excluded from the analyses, providing stronger support for the link between cognitive vulnerability to depression and stress generation. Likewise, Kercher and Rapee (2009) tested an integrated diathesis-stress generation model using a large community sample of young adolescents. Consistent with the stress generation hypothesis, initial cognitive vulnerability (a composite measure combining negative attributional/ inferential style and ruminative response style) predicted dependent stressors at follow-up. This composite score also interacted with stressors to predict depressive symptoms at 6-month follow-up, partially mediating the relation between baseline and follow-up depression (i.e., diathesis-stress/interactional/moderation model).

Many of these abovementioned studies, however, were limited because they failed to fully test the stress generation model (Abela & Hankin, 2011; Auerbach, Eberhart, & Abela, 2010; Gibb et al., 2006; Kercher & Rapee, 2009). More specifically, these researchers failed to differentiate between events that were dependent as opposed to independent of the participants' behaviour, or did not test the whether the cognitive variable(s) of interest uniquely predicted dependent life stress but not independent life stress. Research has consistently shown that individuals with depression or those who are vulnerable to depression are exposed to a greater number of life stressors (e.g., Fergusson & Horwood, 1987; Magnus et al., 1993; Patton, Coffey, Posterino, Carlin, & Bowes, 2003; Van Os & Jones, 1999). Hence, it would not be surprising for cognitively vulnerable individuals to also be exposed to a greater number of total stressors by virtue

of their underlying vulnerability. Stress generation theory specifies that such individuals are specifically exposed to greater levels of dependent stress, and do not differ from nondepressed individuals or individuals vulnerable to depression in their levels of exposure to independent events (Hammen, 2006). Hence, to truly test stress generation, multiple models comparing the prediction of dependent versus independent life stress are warranted.

Overall, the above studies suggest that a variety of cognitive vulnerability factors may influence the generation of stress and subsequent depressive symptoms. Unfortunately, all previous studies in this area have relied exclusively on self-report questionnaires, which may only tap surface level cognitions that result from effortful information processing and may be influenced by participants' expectation, motivation, and mood state (Beevers, 2005; Rude et al., 2010). For example, one of the more common used assessment tools for maladaptive beliefs is the Dysfunctional Attitudes Scale (DAS; Weissman & Beck, 1978). These types of constructs often ebb and flow with depression itself (e.g., Dobson & Shaw, 1987; Lewinsohn, Steinmetz, Larson, & Franklin, 1981), making it difficult to determine if they represent vulnerability factors, concomitants, or "scars" of depression (see Haaga, Dyck, & Ernst, 1991; Scher, Ingram, & Segal, 2005). This uncertainty potentially limits researchers' ability to disentangle the influence of participant mood state from cognition, to examine the unique contribution of cognition to stress generation. Alternatively, depressive cognitions assessed using self-report questionnaires may be actively suppressed by participants through mental thought control (Wenzlaff & Wegner, 2000). In these instances, it is only under conditions of reduced cognitive capacity that depressive cognitions may become measureable. An

alternative to self-report measures involves the use of more automatic information processing, such as interpretive bias, which may less influenced by effortful mental control (Mathews & MacLeod, 2005), may be taxed by experimental manipulations to decrease cognitive capacity (i.e., through the use of cognitive loads; Van der Does, 2005; Watkins & Moulds, 2007; Wenzlaff & Bates, 1998), and may continue to persist and be detectable even when participants are not currently in a dysphoric or depressed mood state (Hedlund & Rude, 1995; Rude et al., 2001).

Stress generation and information processing biases. Interpretation of ambiguity is one information processing variable that may impact stress generation. Certain cognitive predispositions may cause people to respond in positive or negative ways to vague or ambiguous social situations based on their previous experiences, personality traits, and pre-existing attentional and memory biases. For individuals who are in a dysphoric state or are vulnerable to depression by virtue of their depressive self-schema, this tendency can involve noticing and attaching negativity and personal relevance to ambiguous events (Tse & Bond, 2004). In the context of ambiguous interpersonal interactions, the nonverbal behaviours of others may be interpreted as negative or rejecting (Demenescu, Kortekaas, den Boer, & Aleman, 2010; Hokanson, Hummer, & Butler, 1991; Marcus & Askari, 1999; Raes, Hermans, & Williams, 2006).

Theoretically, interpretive bias may lead to the generation of life stressors, which in turn induces depression (see Figure 1). In this model, interpretive biases play a more proximal role in the creation of life stress. When a cognitively vulnerable individual experiences indifference from others, or subtle social ambiguities (e.g., not returning a phone call promptly, not waving hello from across campus, and not smiling

immediately), he or she may interpret these behaviours as intentional signs of dislike, displeasure, or disappointment, *and* react in ways that lead to additional stressors. For example, the individual may then give his or her friend the "cold shoulder", behave in an irritated manner or withdraw from further social contact. All these behaviours have the unfortunate potential consequence of creating an argument or disagreement with a friend, simply because of the interpretation the individual attached to the original behaviour. If instead, he or she had thought "They are just busy" or "They must not have seen me", such potential implications could have been prevented.

Empirical evidence on interpersonal behaviours associated with stress generation supports some of these hypothetical pathways from negative interpretations of ambiguity to stress generation via specific interpersonal competencies and behaviours. For women, interpersonal behaviours such as excessively seeking reassurance, putting others needs first, and depending on interpersonal relationships are especially predictive of dependent life event stress generation (Eberhart & Hammen, 2009; Shih & Auerbach, 2010; Shih & Eberhart, 2010). Furthermore, lower interpersonal competence in the areas of initiating social interactions, conflict management, and hostility were predictive of stress generation at a daily level (Cummings, Hayes, Laurenceau, & Cohen, 2010; Sahl, Cohen, & Dasch, 2009). To the investigator's knowledge, no research has yet examined any forms of information processes biases in the context of stress generation, despite the fact that cognitive theory purports that information processing pathways are the most proximal cognitive link to depression (Beck, 1967, 1987). Hence, one of the main objectives of the current study was to examine interpretive bias as a predictor of stress generation.

Diathesis-Stress, Cognitive Vulnerabilities, and Depression

At the same time, it is important to situate the current study within the context of previous cognition and stress research. One of the most influential models integrating cognitive vulnerabilities and stress in the understanding of depression has been the diathesis-stress model (Beck, 1987; Riskind & Alloy, 2006). From a diathesis-stress perspective, individuals who are vulnerable to depression are indistinguishable in their responses on self-report measures compared to those who are not vulnerable, during regular circumstances (Segal & Ingram, 1994). Cognitive vulnerability emerges and is distinguishable from non-vulnerable individuals, however, when such individuals face situations that activate their depressive self-schemas (Ingram & Luxton, 2005; Monroe & Simons, 1991). From this perspective, the depressive self-schema influences how individuals interpret and experience stressful events, thereby moderating the impact of stressful events (Riskind & Alloy, 2006). When triggered by a stressful event, the depressive self-schema leads to automatic and systematic negative information processing biases (e.g., attention, memory, interpretation, inhibition) which may initiate and/or maintain a dysphoric mood state, leading to greater negative thinking and worsening depressed mood (Ingram et al., 1998). Stated another way, the diathesis-stress model proposes that individuals with particular cognitive tendencies will interpret and react to stressful life events in ways which increase the likelihood of developing depression (e.g., Abramson et al., 1989; Beck, 1987). Hence, the cognitive vulnerabilities moderate the impact of stressful life events on the development of depression.

Empirically, a majority of studies have found support for this proposition in child, adolescent, and adult samples using a variety of cognitive vulnerability variables such as

dysfunctional attitudes, attributional/inferential style, and rumination (for reviews, see Abela & Hankin, 2008; Abramson et al., 2002; D. A. Clark et al., 1999; Garber & Hilsman, 1992; Haaga et al., 1991; Hankin & Abela, 2005; Ingram et al., 1998; Lakdawalla, Hankin, & Mermelstein, 2007; Scher et al., 2005; Segal & Ingram, 1994). For example, Seeds and Dozois (2010) found that the interaction of self-schema structure and negative life events in undergraduate students predicted depressive symptoms over a 1-year period. Beyond simple two-point prospective assessments, multiwave, time-lagged, and daily diary studies have also examined diathesis-stress models to provide a more stringent exploration of this hypothesis (e.g., Abela & Hankin, 2011; Abela & Skitch, 2007; Hankin, 2010; Hankin, Wetter, Cheely, & Oppenheimer, 2008; Klocek, Oliver, & Ross, 1997; Mezulis, Funasaki, Charbonneau, & Hyde, 2010). For instance, in a three-wave study with community youth, Mezulis and colleagues (2010) found that the interactions between attributional/inferential style and both total and dependent life stress were significant in predicting depression symptom trajectories in girls, but not boys, over a four-year period. The most compelling evidence supporting the diathesis-stress hypothesis, however, comes from studies that have examined the interaction between cognitive vulnerability and stressful life events to prospectively predict the onset of major depressive episodes (Alloy et al., 2006; Carter & Garber, 2011; Evans, Heron, Lewis, Araya, & Wolke, 2005; Hankin, Abramson, Miller, & Haeffel, 2004, study 2; Lewinsohn, Joiner, & Rohde, 2001). In the most recent of these, the interaction of negative cognitions and interpersonal stress predicted the first onset of a major depressive episode in adolescents (Carter & Garber, 2011). Together, these results provide strong support for a cognitive diathesis-stress model of depression.

Unfortunately, similar to the issue noted in the review of cognitive vulnerabilities and stress generation, no one has examined information processing biases, such as interpretive bias, in the context of diathesis-stress models (Ingram et al., 2008). As with the cognitive vulnerability research in the area of stress generation, all previous studies applying a diathesis-stress model have relied exclusively on self-report questionnaires which are open to response biases. Theoretically, interpretive biases may function as cognitive diatheses that interact with stress to produce increases in depressive symptoms and potential depressive episodes (diathesis-stress/moderation framework). One might imagine that a cognitively vulnerable individual interprets ambiguous social information in a persistently negative manner. Stressful life events may give rise to a pattern of maladaptive self-referent information processing and increased negative interpretation of ambiguity that begins the downward cycle toward depression (Riskind & Alloy, 2006). Such individuals may start to be more critical of themselves, their future, and others. They may start to view other's indifference or subtle social ambiguities (e.g., not returning a phone call promptly, not waving hello from across campus, and not smiling immediately) as intentional signs of dislike, displeasure, or disappointment. These negative interpretations and subsequent catastrophic thinking would serve to further worsen the person's mood. In contrast, individuals without interpretive biases would experience negative mood and related thoughts that are commensurate to the nature of the stressful life event (Ingram, Miranda, & Segal, 2006).

As previously discussed, there is some indirect evidence from CBM-I studies that interpretive bias operates as a diathesis within this type of model, with experimental manipulation of interpretation resulting in attenuated emotional reactions following

subsequent stressors (Lester et al., 2011; Mackintosh et al., 2006; Wilson et al., 2006), buffering against the impact of a negative mood induction procedure (Holmes et al., 2009), and improving mood in individuals with clinical depression (Blackwell & Holmes, 2010). Prospectively, interpretive bias, in the context of one form of stress (i.e., school examinations), has also been shown to predict dysphoric reactions up to one month later (Pury, 2002). Hence, a further objective of the current study was to examine interpretive bias in the context of a diathesis-stress model using the occurrence of naturalistic life events.

Rationale and Objectives for the Current Study

At this point, it is unknown if interpretive biases may lead to stress generation, and how the combination of interpretive biases and stress may contribute to depression. The main rationale for the current study is to investigate these two theoretically and empirically supported models, as a way of integrating the information processing variable of interpretive bias, with the broader cognitive vulnerability literature. Although some forms of interpretive bias appear to lead to depression, the mechanism by which this may occur and in what contexts is not known. Interpretive biases themselves may lead to the generation of life stressors, which in turn contribute to depression. Interpretive biases may also function as cognitive diatheses that interact with stress to produce increases in depressive symptoms and potential depressive episodes (diathesis-stress/moderation framework). While there is some evidence that interpretive bias may moderate individuals' reactions to stress (e.g., Holmes et al., 2009; Mackintosh et al., 2006; Wilson et al., 2006), this has never been examined in non-experimentally manipulated samples or in the additional context of stress generation. Furthermore, no studies of interpretive bias

have examined both diathesis-stress and stress generation models in the same sample, despite the fact that studies of cognitive vulnerability routinely do so (e.g., Abela & Hankin, 2011; Gibb et al., 2006; Hankin, Stone, & Ann Wright, 2010; Kercher & Rapee, 2009; Mezulis et al., 2010). Hence, the current study aims to examine interpretive bias in the context of these two models. If both models hold, it would provide further evidence for the problematic situation which cognitively vulnerable individuals face—not only are they more likely to develop depression following stressors, but they may, in part, be contributing to the creation of the stressors that will trigger, maintain, and/or exacerbate their depression.

Therefore, the overarching goal of this project was to examine interpretive bias for ambiguous social information within the context of stress and depression. Two measures of interpretive bias were employed, as is standard in this research literature (Dearing & Gotlib, 2009; Eley et al., 2008; Mogg et al., 2006). The currently most reliable and valid measures were selected assess the construct of interpretive bias. First, the Scrambled Sentences Task (SST) was selected since it is the most widely used measure of interpretive bias and had been shown to have a causal relationship with depressive symptoms and syndrome over time (Phillips, Hine, & Thorsteinsson, 2010; Rude et al., 2002, 2003, 2010). Second, the ambiguous stories priming paradigm (called the Ambiguous Stories Task; AST) utilized by Dearing and Gotlib (2009) was selected because it used self-referent material and derived reaction-time indicators of interpretive bias which are least open to response bias and demand characteristics of participants (Dearing & Gotlib, 2009; Wisco, 2009; Wisco & Nolen-Hoeksema, 2010).

Given the importance of assessing whether interpretive bias could predict *future* stressful life events and depressive symptoms, the current study utilized a two-wave prospective design over a five-week period. This length of follow-up was selected based on previous research examining stress generation and changes in depressive symptoms (e.g., Abela & Hankin, 2008; Auerbach et al., 2010; Gibb et al., 2006; Shih, 2006). This design allowed for multiple points of measurement of depressive symptoms using a well-validated instrument (Beck, Steer, & Brown, 1996). To control for past lifetime experiences with depression, participants' worst prior history of depressive symptoms was also ascertained using a psychometrically strong measure and current diagnostic criteria for MDD (Zimmerman & Coryell, 1987). Additionally, this study utilized a comprehensive list of life events that was scored for independence and dependence by Ph.D.-level raters with experience in contextual rating systems (Brown & Harris, 1978).

Young adult women were recruited for this study because of the heightened period of risk during the transition to adulthood, their higher likelihood of exposure to stressful life events, and their increased risk of developing depression (e.g., Burke, Burke, Regier, & Rae, 1990; Hankin et al., 1998; Harkness et al., 2010; Safford et al., 2007; Shih, 2006; Shih et al., 2006). Many studies on stress generation or interpretive bias have focused their investigations solely on women (e.g., Daley et al., 1997; Davila et al., 1995; Eberhart & Hammen, 2009; Hammen, 1991; Rude et al., 2010). Consequently, sampling exclusively women provided a promising starting point to detect stress generation and diathesis-stress effects, if they existed.

Question 1 - Does interpretive bias predict changes in depressive symptoms? Given mixed findings in previous research (e.g., Bisson & Sears, 2007; Dearing &

Gotlib, 2009; Lawson et al., 2002; Mogg et al., 2006; Nunn et al., 1997; Sears et al., 2011), the first objective of the current study was to explore whether interpretive bias, as measured by the SST and AST, was related to concurrent depressive symptoms and depression symptom history. The extent to which interpretive biases predicted changes in depressive symptoms over the 5-week follow-up was also examined (e.g., Rude et al., 2002). In the prospective analyses, both prior depression symptom severity and baseline depressive symptoms were controlled statistically, which is consistent with previous studies in this area (Rude et al., 2002, 2003, 2010). This procedure allowed for an investigation of the unique effects of interpretive bias above and beyond the effects of previous depressive symptomatology (e.g., Rude et al., 2002).

In general, interpretive biases assessed at Time 1, as measured by the SST and AST, were expected to be related to Time 1 depressive symptomatology and depression symptom history. More specifically, concurrent depressive symptoms and positive depression symptom history were expected to be related to a greater proportion of negative sentences constructed on the SST and to faster response latencies for negative story endings (and slower reactions times for benign or positive story endings) on the AST.

Interpretive biases were also hypothesized to predict Time 2 depression symptoms, over and above the effects of Time 1 depression symptoms and depression symptom history (Rude et al., 2002, 2003, 2010). In particular, a higher proportion of negative sentences constructed on the SST, as well as faster response latencies for negative story endings and slower response latencies for benign or positive story endings

on the AST, were hypothesized to predict greater increases in depressive symptoms over the 5-week period.

Question 2 - Does interpretive bias predict stress generation? The second objective of this project was to examine interpretive bias for ambiguous social information as a contributor to stress generation. More specifically, whether interpretive biases to ambiguous scenarios contribute to the generation of dependent (but not independent) life events was examined over a prospective interval of five weeks. Given that prior depression (e.g., Davila et al., 1995) and current depressive symptoms (Potthoff et al., 1995) both predict stress generation, these variables were controlled statistically. This procedure helped to safeguard against potential mood-congruent biases in reporting and allowed for an examination of the effects of interpretive bias beyond any effects of depression.

Generally, interpretive bias was expected to uniquely predict the occurrence of dependent life events, and be unrelated to the frequency of independent life events reported by participants. Specifically, a higher proportion of negative sentences constructed on the SST, as well as faster response latencies for negative story endings and slower response latencies for benign or positive story endings on the AST, were hypothesized to predict the occurrence of more life stressors at least partially dependent on participants' behaviours (i.e., dependent events) by Time 2. The indices of interpretive bias were not expected to be predictive of the occurrence of fateful stressors (i.e., independent events), as is consistent with the stress generation hypothesis (Hammen, 1991, 1992, 2006). These relationships were hypothesized to exist, controlling for the effects of Time 1 depression symptoms and depression symptom history.

Question 3 - Does interpretive bias interact with stressful life events to predict changes in depressive symptoms? As a complement to the stress generation model, the third aim of this study was to examine interpretive bias within the context of a diathesis-stress framework (interactional/moderation model; Beck, 1987). Within this model, interpretive biases were expected to interact with life stressors to predict increases in depressive symptoms across time. In particular, individuals with negative interpretive biases, in the context of heightened life stressors, were expected to experience greater increases in depressive symptomatology compared to those with fewer life stressors or with more adaptive forms of interpretive bias (i.e., moderation). More specifically, participants who solved a higher proportion of sentences with negative solutions on the SST, and participants who displayed faster response latencies for negative story endings and slower response latencies for benign or positive story endings on the AST, in the context of higher frequencies of life events, were hypothesized to be at the most elevated risk for increases in depressive symptoms, compared to participants with lower frequencies of life events or more positive patterns of interpretive bias. Given the well-known fact that past depression is the best predictor of future depression (Hankin et al., 1998; Harrington, Fudge, Rutter, Pickles, & Hill, 1990; Lewinsohn, Zeiss, & Duncan, 1989; Rao, Hammen, & Daley, 1999; for review, see Burcusa & Iacono, 2007), the analyses for this hypothesis also statistically controlled for prior depression symptom severity and baseline depressive symptoms.

Method

Participants

Two-hundred-and-sixteen first-year psychology undergraduate women[2] completed the first wave of data collection of this study (Time 1). This sample size was selected to be consistent with previous sample sizes used in cognitive vulnerability to depression studies using undergraduate student populations (e.g., Gibb et al., 2006; Hankin, 2010; Shih et al., 2009; Uhrlass & Gibb, 2007), as well as sample sizes typically utilized in our research laboratory (e.g., Brinker & Dozois, 2009; Covin, Dozois, Ogniewicz, & Seeds, 2011; Frewen & Dozois, 2006a, 2006b). At the second wave of data collection (Time 2), 209 participants completed at least a portion of the measures and 207 participants completed all Time 2 measures (96% retention rate)[3]. Psychology 1000/1200 students were recruited using the Psychology Research Participant Pool ($n_{\text{Time 1}} = 205$; $n_{\text{Time 2}} = 196$). Other students enrolled in first-year courses ($n_{\text{Time 1}} = 11$; $n_{\text{Time 2}} = 11$) were recruited using posters that were distributed at different locations throughout the

[2] The rationale for the gender-specific sampling method is fourfold: (1) the transition period from late adolescence to early adulthood is a heightened period of vulnerability for depression in women (Burke, Burke, Regier, & Rae, 1990); (2) women are twice as likely to encounter significant experiences with depression compared to men in general (Hankin et al., 1998); (3) vulnerable women are more likely to experience life events and the stress generation effect compared to men (Safford, Alloy, Abramson, & Crossfield, 2007; Shih, 2006; Shih, Eberhart, Hammen, & Brennan, 2006); (4) young adulthood is the main period when the women's rates of life events prior to the onset of a depressive episode are particularly elevated compared to men (Harkness et al., 2010). Many studies on stress generation or interpretive bias have focused their investigations solely on women (e.g., Daley et al., 1997; Davila, Hammen, Burge, Paley, & Daley, 1995; Eberhart & Hammen, 2009; Hammen, 1991; Rude, Durham-Fowler, Baum, Rooney, & Maestas, 2010). Consequently, sampling exclusively women provided a promising starting point to detect stress generation effects, if they existed.

[3] Comparison statistics were conducted to investigate any differences between those participants who completed both waves of data collection and those who did not. For details of these analyses, please refer to Appendix A. Based on the very small attrition rate and the minor differences found, it is unlikely that the results of this study were significantly influenced by the 9 dropouts.

university campus[4].

Measures

Demographic Questionnaire. A standard questionnaire was administered to participants to assess various demographic (e.g., age, gender, ethnicity, marital status) and clinical (i.e., personal history of previous mental disorder; previous treatment received) characteristics (see Appendix C for a copy).

Beck Depression Inventory – II (BDI-II). The BDI-II was completed by all participants to assess the current severity of their depressive symptoms (Beck et al., 1996). The BDI-II is a standardized 21-item self-report measure of depression. Participants rate each item on a 4-point (0 to 3) scale by selecting the statement for a given question that best matches their experience in the preceding two weeks. An example of these types of questions is "sadness", and the participants choose one of "I do not feel sad", "I feel sad much of the time", "I am sad all of the time", or "I am so sad or unhappy that I can't stand it" (Beck et al., 1996). A total score is calculated by summing across the items, with higher scores indicating a greater severity of depression. The BDI-II has excellent internal reliability (average coefficient alpha = .91; Dozois & Covin, 2004) and good test-retest reliability (ranging from .60 to .83 for non-psychiatric samples; Dozois & Covin, 2004), as well as excellent content, construct, concurrent, and discriminant validity (see Dozois & Covin, 2004, for a comprehensive review of the psychometric properties). The BDI-II exhibited excellent internal consistency in the current study ($\alpha = .91$ for Time 1 and $\alpha = .93$ for Time 2).

[4] Comparison statistics were conducted to investigate any differences between participants recruited via different methods. For details of these analyses, please refer to Appendix B. Based on the very small sample size and minor differences found, it is unlikely that the results of this study were significantly influenced by the 11 participants recruited by posters on campus.

Inventory to Diagnose Depression, Lifetime Version (IDD-L). The IDD-L was used to assess participants' worst prior experience of depression (Zimmerman & Coryell, 1987). For the purposes of the current study, 21 symptom items and 21 duration items from the IDD-L were used (out of the original 22), which are originally based on the diagnostic criteria for a major depressive episode in the *Diagnostic and Statistical Manual of Mental Disorders-III* (DSM-III; American Psychiatric Association, 1980). Only the items consistent with the more recent edition of the DSM (DSM-IV-TR; American Psychiatric Association, 2000) criteria for depression were used. Participants were asked to recall the most depressed week in their lives and then rate the 21 symptom items on a 5-point scale, by choosing the statement that best matched the symptom severity during the time in their lives when they "felt the most depressed." Participants also indicated whether this symptom lasted for two weeks or longer, using the duration items. For the purposes of the current study, the IDD-L was scored in a continuous format. Only those symptoms which were endorsed for longer than 2 weeks were included in the total score, as is consistent with previous utilization of this measure (Cummings et al., 2010; Rude et al., 2002, 2003, 2010). The IDD-L has strong reliability and validity (e.g., Goldston, O'Hara, & Schartz, 1990; Sakado, Sato, Uehara, Sato, & Kameda, 1996; Sato et al., 1996; Zimmerman & Coryell, 1987). Internal reliability in the current study was excellent ($\alpha = .94$).

Scrambled Sentences Test (SST). The SST (Wenzlaff, 1988, 1993) was used to measure participants' tendency to interpret ambiguous information (e.g., *winner born I am loser a*) in a positive (e.g., *I am a born winner*) or negative (e.g., *I am a born loser*) manner. Several studies have shown differences between currently depressed, previously

depressed, and never-depressed participants on this task (e.g., Hedlund & Rude, 1995; Rude, Covich, Jarrold, Hedlund, & Zentner, 2001; Wenzlaff, 1988; Wenzlaff & Bates, 1998). Participants were presented with two blocks of up to 20 scrambled sentences (in random order) and were instructed to click a number below five of the six words of each scrambled sentence to produce a grammatically correct sentence (see Appendix D for these stimuli). Participants were instructed to complete as many of the sentences as possible during each 2.5-minute block, consistent with previous studies utilizing this task (e.g., Holmes et al., 2009; Rude et al., 2002, 2003). A count-down clock and number of trials completed out of 20 was presented at the top of the computer screen which allowed participants to see their progress. The purposes of the time limit was to create consistency across participants in their available time to solve the sentences and to encourage them to work as quickly as possible, thereby interfering with effortful deliberation on their solutions to the sentences (Phillips et al., 2010).

Consistent with previous uses of the SST (e.g., Rude et al., 2002, 2003; Wenzlaff, 1993), a cognitive load procedure was used in either the first or second block of the task. The rationale for providing a cognitive load to participants (versus no-load) was to help mitigate against potential demand characteristics and self-presentation biases and access more fundamental information processing vulnerability (e.g., Rude et al., 2002, 2003, 2010; Wenzlaff, Rude, Taylor, Stultz, & Sweatt, 2001). In the cognitive load condition, participants were given a six-digit number to remember while they completed the task. Although the size of the cognitive load was not calibrated for each participant individually, the current procedure had the advantage of allowing group administration and has shown the predicted effects in previous studies (e.g., Wenzlaff & Wegner, 2000).

Participants were asked to provide the six-digit cognitive load number at the end of the 2.5-minute block and their accuracy was examined. Eighty-seven percent of participants reported the number with perfect accuracy.[5]

The order of the load and no-load conditions was counterbalanced, with approximately half of the participants (n = 103) completing the first block of scrambled sentences under cognitive load followed by the second block without load. A negativity score for each block was calculated by computing the ratio of negative sentences divided by total sentences completed (out of 20 possible). Consistent with previous studies using this measure, interpretive bias for the SST was operationally defined as a higher negativity score on the cognitive load and no-load conditions (Holmes et al., 2009; Rude et al., 2003, 2002).

Ambiguous Stories Task (AST). The AST was adapted from Dearing and Gotlib (2009) and derived from a procedure used by Mathews and his colleagues (e.g., Hirsch & Mathews, 1997; Mathews & Mackintosh, 2000). In this task, participants were presented with short stories in which the emotional valence remained ambiguous until the final word was presented. On some trials, the target word resolved the ambiguity in a valenced manner (positive or negative), whereas in other trials grammatically impossible foil items were presented. Participants were asked to indicate with a key press whether the word presented was grammatically correct, and response latencies were recorded.

Participants were provided with 65 three-sentence stories written in a self-referent, second-person narrative style (e.g., "You are…"). The application of a self-

[5] Participants who made errors in the recall (n = 28) were excluded from all subsequent analyses using this measure of interpretive bias. In most instances, participants either substituted one or more of the 6 digits for a different digit, or only recalled 5 out of 6 digits.

referent narrative is important because information processing biases in depression are stronger when stimuli are self-referent (Dineen & Hadwin, 2004; Nunn et al., 1997; Wisco, 2009). Stories were presented one sentence at a time, self-paced by having the participant press the space bar to move to the next sentence. Each story's final word was missing from the third sentence, and participants were encouraged to think of an ending for each story. Once they had the ending in mind, participants were instructed to press the space bar to see a single probe word appear on the screen. At this point, participants had to press a key to indicate whether or not the word represented a grammatically possible ending to the story. After the probe word, participants were asked to respond to a comprehension (yes/no) question that was unrelated to the story ending. Answers to the comprehension questions were followed by immediate feedback (e.g., "Right!" or "Wrong, try again next time") in order to emphasize the importance of reading and understanding the story. In other words, the expected semantic meaning of the stories was primed by asking participants to think of a possible ending. This true purpose was veiled by requiring participants to make grammatical and reading comprehension decisions during the task, rather they semantic ones (Dearing & Gotlib, 2009; Hirsch & Mathews, 1997; Mathews & Mackintosh, 2000). Please refer to Appendix E for a complete version of the stories and their possible endings.

Control items on this task consisted of unambiguously neutral stories with a neutral final word (n = 5) or grammatically impossible foil (n = 10). An example of a control story reads:

1. You have planned to meet a friend at the mall.

2. When you arrive, she's not there, so you call her cell phone to find out where she is.
3. She explains that her mom was late picking her up because she got stuck in _____.
4. Probe word: traffic (participant should press "yes" key)
5. Comprehension check: Did you call your friend to find out where she was? (participants should press the "yes" key).

Test items allowed for a positive or negative interpretation of the story. An example of a test item reads:

1. You have been writing to your new roommate over the summer.
2. Tomorrow you are going to meet your roommate for the first time.
3. As you think about meeting her for the first time, you feel that she will think you are _____.
4. Probe word: Friendly (*friendly* - positive ending; *annoying* - negative ending; *pleasure* – grammatically impossible foil)
5. Comprehension check: Had you met your roommate before? (participants should press the "no" key).

The number of possible and impossible endings was counterbalanced across the entire stimulus set. For test items, one third of the test sample set contained endings that resolved the story in a negative, positive, or grammatically impossible manner. Stories from Dearing and Gotlib's study (2009) of pre-adolescent girls were adapted for the current study to be more age-appropriate for a post-secondary school sample. This task was evaluated in a pilot study to ensure that the control stimuli were indeed unambiguous

and that the test stimuli were amenable to both positive and negative interpretations. Sixteen graduate-level students were presented with all 65 stories and asked to fill in the blank at the end of each story with a positive and/or negative word that would complete the story in a grammatically possible way. Pilot responses to control stories were completely consistent with the developed endings, with participants recording the expected ending or a grammatically equivalent synonym 93% of the time. Responses to test (ambiguous) stories showed that alternate interpretations were possible, with participants writing down identical or similar positive and negative endings 62% and 38% of the time, respectively. These findings suggested that control stimuli were unambiguous and test stimuli were amenable to multiple interpretations (Dearing & Gotlib, 2009).

Positive, negative, and impossible endings were randomized across participants, and the order of presentation of stories was fully randomized for each participant. Stimuli were presented in three blocks, each consisting of 21 or 22 trials, on an IBM-compatible personal computer and a Samsung 17 inch colour monitor. Interpretation bias for this task was operationally defined in relation to the response latencies for test trials. Participants were expected to be slower to respond "yes" to grammatically possible endings that were *inconsistent* with their interpretation of the story than grammatically possible endings that were consistent with their interpretation (see MacLeod & Cohen, 1993). Therefore, the main trials of interest were response latencies on test trials in which participants responded "yes" to negative endings or "yes" to positive endings (Dearing & Gotlib, 2009). Responses in which they replied "no" to possible endings (either negative or positive), or "yes" to grammatically impossible endings, were considered errors and were

not relevant to the current investigation. In the current study, it was expected that interpretive bias would be manifested as faster response times for test trials with negative endings (facilitation) and slower response times for test trials with positive endings (interference). Previous work has shown that girls at-risk for depression are more likely to impose negative interpretations and less likely to impose positive interpretations on ambiguous information, compared to girls at low-risk for depression (Dearing & Gotlib, 2009).

Stressful Life Experiences Questionnaire (SLEQ). A 260-item measure of negative life events and hassles was created for the current study. Items for this composite measure were drawn from existing life event checklists and interviews, to ensure that coverage of all potential themes and domains of life events (e.g., school, home, family and friends, marriage and dating, parenting, crime/legal, work, finances, migration, bereavement, other) were captured and to ensure that a sufficient number of events could be differentiated clearly as dependent and independent. *Dependent events* were operationalized as at least in part dependent on the actions of the individual (e.g., intentional act by participant, negligence, argument, end of contact/breakup; Brown & Harris, 1978). *Independent events* were operationalized as events that are independent of the participant's actions (e.g., family moves away, victim of natural disaster, witness to fight but not involved, physically ill).

Life events and hassles were drawn from the Adolescent Life Events Questionnaire – Revised (Hankin & Abramson, 2002), the College Student Life Event Schedule (Sandler & Lakey, 1982), the Daily Hassles and Uplifts Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981), the Hassles and Uplifts Scale (DeLongis, Folkman, &

Lazarus, 1988), the Life Experiences Survey (Sarason, Johnson, & Siegel, 1978), the Negative Daily Stressors Checklist (Sahl et al., 2009), the Negative Life Events Questionnaire (Metalsky & Joiner, 1992) and the Positive and Negative Event Scales (Maybery, 2003). For each of the items on the life events measure, participants were asked to indicate if the event occurred during the five weeks between the Time 1 and Time 2 assessment and, if so, the degree of its impact on their lives. To reduce potential response bias associated with depressive symptoms, the number of events endorsed over the 5-week period (rather than the subjective impact ratings) was emphasized. A sum of dependent and independent events was calculated.

Using a procedure similar to several previous studies that have utilized questionnaire-based methods to assess life events, the final list of life events was coded a priori for independence/dependence (e.g., Auerbach et al., 2010; Iacoviello, Grant, Alloy, & Abramson, 2009). Ratings were independently conducted by the study author and a Ph.D. level psychologist, both with experience and training as raters for the gold standard contextual life event rating system (i.e., The Life Events and Difficulties Schedule [LEDS; G. W. Brown & Harris, 1978]) and highly familiar with concepts of independence and dependence of life events. The LEDS rating system provides over 5,000 examples of contextual life events and rating rules, with which rating teams must apply ratings based on a specific example that seems most similar to the event being currently rated. In the present study, both raters had over two years of experience working on consensus teams, making ratings about independence/dependence based on the context of events using the LEDS-II manual with adolescent and adult samples (Bifulco et al., 1989; Brown et al., 1992; Brown & Harris, 1989; Frank, Matty, &

Anderson, 1997). Items whose coding was agreed upon were retained. Items which were not categorized into dependent versus independent were excluded from statistical analyses (see Appendix F). Cohen's kappa coefficient, as calculated for these independent, dependent, and neither/unsure event codes, was 0.72, indicating a moderate to substantial level of agreement among raters (Fleiss, 1971; Landis & Koch, 1977; Posner, Sampson, Caplan, Ward, & Cheney, 1990; Shrout, 1998; Sim & Wright, 2005). Including the combination of major life events and hassles in the assessment of life stress ensured that there were sufficient events experienced by participants over the 5-week interval, thereby enhancing statistical power (e.g., Alloy, Reilly-Harrington, Fresco, Whitehouse, & Zechmeister, 1999).

An overall total number of life events endorsed was calculated (out of a possible 160 events). Of those items, 34 were coded as independent and 105 as dependent (20 items were not categorized and were excluded from the life event subscales). Item response on the life event checklist varies according to the type and frequency of the life stress experiences; thus, the calculation of internal consistency coefficients is not appropriate for this type of scale. However, other researchers have sometimes calculated internal consistency as a proxy of degree of stressfulness of individuals' lives and/or their tendency to report life events (e.g., Wingate & Joiner, 2004) and hence they can be calculated; in the current study, the internal consistency (α) for the SLEQ dependent events and SLEQ independent events were .92 and .77, respectively. The frequency of life events in the current study is relatively consistent with previous studies using self-report checklists to assess life event occurrence of a similar time interval (Gibb et al., 2006; Hankin et al., 2010; Uhrlass & Gibb, 2007). Length of time between Time 1 and

Time 2 appointments was not related to the number of overall life events, $r(206) = -0.04$, $p = 0.58$, number of independent life events, $r(206) = -0.03$, $p = 0.72$, or number of dependent life events , $r(206) = -0.03$, $p = 0.70$, which participants reported during the 5-week interval.

Procedure

Participants were recruited through the Psychology Research Participant Pool or through posters on campus at the University of Western Ontario. Permission to conduct this investigation was provided by the university Institutional Ethics Review Board (see Appendix G). Those individuals willing to participate were provided with a letter of information and completed the process of informed consent, which was confirmed by signing a consent form. Participants completed a 2-hour protocol (Time 1), in groups of one to five. A clinical psychology graduate student or undergraduate volunteer student, who had received training on all of the measures, conducted this assessment. Subsequent to that assessment, participants were asked to complete an online Time 2 assessment 5 weeks ($M = 34.93$ days, $SD = 2.13$ days, Range = 32 - 46 days) later which was approximately 30 minutes in duration ($M = 23.14$ minutes, $SD = 12.26$ minutes, Range = 6 - 88 minutes). For the second assessment point, participants were emailed a link to a webpage where they could complete the follow-up portion of this study. A 5-week follow-up period was selected based on past research (e.g., Abela & Hankin, 2008; Auerbach et al., 2010; Gibb et al., 2006; Shih, 2006). This time interval appears to be useful for examining the generation of life events and prospective changes in depressive symptoms.

At Time 1, participants completed all symptom questionnaires and computer tasks at the in-person assessment meeting. At the start of the administration session, the computer-based information processing tasks (AST and SST), as well as other information processing measures that are not applicable to the current investigation, were presented to participants in random order. During the second portion of the experiment, self-report questionnaires were presented in random order along with additional measures that are not the focus of the current study. At the 5-week follow-up session (Time 2), participants were asked to complete a subset of the measures that they completed at the Time 1 (including the BDI-II and the life events questionnaire) using a secure website. A benefit of this procedure was that the exact date and time when the assessments took place could be determined which ensured that the questionnaires were completed as scheduled (e.g., Gibb et al., 2006). Upon completion of the study, participants were debriefed regarding the study's purpose, thanked for their participation, and provided with participant credit for their introductory psychology class. For participants who completed only the first in-person assessment, 2.0 participant credits or $20 was awarded depending on their method of recruitment. If participants opted to complete the follow-up assessments, they earned an additional 1.0 credit for their participation (for those in the Research Participant Pool) or were entered in a draw for one of several $100 gift cards to a local shopping centre with a 1 in 10 chance of winning.

Data Analytic Strategy

Only data for participants who completed both Time 1 and Time 2 assessments were included in the analyses. All variables were standardized prior to analyses, where

appropriate. To address each of the research questions, the following data analytic approaches were utilized.

Question 1 - Does interpretive bias predict changes in depressive symptoms? Bivariate and partial correlation analyses were performed to investigate the cross-sectional relationships among interpretive bias variables (SST and AST) and Time 1 depressive symptomatology (BDI-II) and depression symptom history (IDD-L). A series of hierarchical linear regression analyses were conducted to examine whether interpretive bias predicted follow-up depressive symptoms. In these regressions, scores on the BDI-II at Time 2 served as the criterion variable, and any correlated demographic characteristics (based upon preliminary analyses), BDI-II at Time 1, and IDD-L at Time 1 were entered as covariates. Separate regression analyses were run for each of the indices of interpretive bias (e.g., average RT for positive target trials on the AST, negativity ratio for the cognitive load condition on the SST).

Question 2 - Does interpretive bias predict stress generation? A series of negative binomial regressions were conducted using Stata 11.0 to investigate whether interpretive bias measures predicted stress generation. Hierarchical models involving a count outcome variable (e.g., number of dependent events) are typically conducted using a Poisson distribution rather than a normal distribution (Raudenbush & Bryk, 2002). Negative binomial regressions belong to Poisson-class regression models, and were deemed to be most appropriate in the current study (please refer to Appendix H for a detailed description). Two sets of regressions were conducted, one with each of the count data of independent and dependent life events serving as the criterion variable. In all regressions, any correlated demographic characteristics (based upon preliminary analyses), BDI-II at Time 1, and IDD-L at Time 1 were entered as covariates. Similar to

hypothesis 1, separate regression analyses were conducted for each of the indices of interpretive bias.

Question 3 - Does interpretive bias interact with stressful life events to predict changes in depressive symptoms? To examine a diathesis-stress/moderation model of depression, a series of hierarchical linear regression analyses was conducted according to Baron and Kenny's (1986) guidelines. In these analyses, the interaction between each baseline interpretive bias variable and dependent stress was examined as a predictor of follow-up BDI-II scores. Consistent with Friedrich's (1982) procedure, the cross-product of the standardized independent variables was used as the interaction term. The main effects of each interpretive bias variable, dependent stress, baseline BDI-II scores, previous depression symptom history and independent life stress were controlled statistically. Follow-up analyses were conducted, as necessary, according to Aiken and West's (1991) procedure.

Influential observations. Sample sizes in the regression analyses vary due to exclusions of influential cases (i.e., outliers), based on Cook's *D* statistic (Tabachnick & Fidell, 2007). In regression analyses, if the removal of an observation produces substantial changes in the estimates of the regression coefficients, then that observation is considered influential (Tabachnick & Fidell, 2007). Influence is the product of leverage and discrepancy, with leverage referring to how far away an observed predictor is from its mean and discrepancy referring to how unusual an observed outcome score is given the combination of predictor variables (Fox, 2008). Cook's *D* statistic provides a summary index of the influence that an observation has on the regression coefficients. In all subsequent linear regression analyses, Cook's *D* statistic was used to identify

participants who could be excluded from analyses to produce more stable regression coefficients. In each instance, analyses were rerun removing cases with extreme values of Cook's *D* to determine whether the results changed with the removal of the influential case(s). In most analyses, the removal of the most influential cases did not alter the significance of the model statistics but did alter the level of significance for the regression coefficients. As such, participants were excluded from each analysis repeatedly and systematically, until no significant influential cases were detected using Cook's *D* statistic.[6]

[6] Some researchers suggest that all statistical analyses should also be conducted including any observations that were eliminated (Simmons, Nelson, & Simonsohn, 2011). As such, each of the main statistical analyses was repeated including all observations (n = 207). Please see each hypothesis in the results section for the outcome of these analyses.

Results

Descriptive Characteristics of the Sample

The average age of participants was 18.57 years (*SD* = 2.83, Range = 16 - 47). Consistent with the ethnic variability within the university, most of the students reported that their ethnicity was White/Caucasian (*n* = 142; 68.6%). Other ethnicities represented in the sample included Asian (*n* = 42; 20.3%), Black/African Canadian (*n* = 7; 3.2%), East Indian (*n* = 4; 1.9%), and Aboriginal/Native Canadian (*n* = 2; 1.0%). Ten participants (4.8%) categorized themselves in an "Other" ethnic group, and provided descriptions of ethnic categories not covered in the main questionnaire (e.g., Muslim, Middle Eastern, Arabic) or mixed ethnicities (e.g., Part Lebanese/Part Indian; Canadian/Trinidadian). Most of the women reported that they were single (*n* = 202; 97.6%), but a few were married/common-law/engaged (*n* = 3; 1.4%) or divorced/separated (*n* = 2; 1.0%).

Ten participants (4.8%) reported that they have been diagnosed with one or more mental disorders in the past. The description of these diagnoses included depression, obsessive compulsive disorder, generalized anxiety disorder and social phobia. Sixteen participants (7.7%) reported that they had received medication(s) for an emotional or psychological problem. Thirty-nine participants (18.8%) reported that they had received therapy or counselling for an emotional or psychological problem.

Preliminary Analyses

Data reduction. Response latencies on the AST were analyzed to test the hypotheses that interpretations bias, defined as a greater tendency to impose negative interpretations and a decreased tendency to impose positive interpretation on ambiguous

information, would predict depressive symptoms and life stressors. Only response latencies from correct responses to *both* the target word and the comprehension question were analyzed (Dearing & Gotlib, 2009). Error rates across all conditions were low (mean for target word accuracy = 0.09; mean for comprehension accuracy = 0.08). Error rates did not differ as a function of Time 1 BDI-II scores (*p*s ranging from .06 to .11) or depression symptom history as assessed by the IDD-L at Time 1 (*p*s ranging from .37 to .87). The proportion of data lost due to errors was inspected for each participant; based on these data, 23 participants were excluded due to an unusually high number of incorrect answers to the questions (fewer than 70% of the target and comprehension questions were both answered correctly), suggesting that these participants had difficulty comprehending the task requirements or were not attentive to the task.

Furthermore, to prevent outlier data from unduly influencing participant means, latencies greater than three standard deviations above and below each participant's mean were excluded. In addition, response latencies lower than 300 ms were considered anticipation errors and were also excluded from further analyses. Response latencies greater than 3,000 ms were excluded because they likely reflected lapses in attention to the task. The proportion of data lost due to outliers was inspected for each participant; based on these data, no participants were excluded due to an unusually high number of response latencies classified as outliers. The proportion of data lost due to outliers was less than 3%, and is comparable to the rates lost due to errors and outliers found in similar text comprehension paradigms (Dearing & Gotlib, 2009; Mogg et al., 2006).

Preliminary analyses were conducted to examine whether participants differed in their overall reaction times depending on the valence of the probe word (i.e., the way in

which the stories resolved; positive or negative) and whether participants as a whole responded more rapidly in affirmative conditions than in conditions in which the 'no' response was correct. There was a significant difference in the mean reaction time for negative target trials and positive target trials on the Ambiguous Stories Task; participants, in general, were slower to react to possible negative target trials as compared to possible positive target trials, paired $t(183) = -10.98$, $p < 0.001$. This finding is consistent with previous research utilizing this measure (Dearing & Gotlib, 2009). Participants in this study responded equally quickly in the affirmative conditions ($M = 1.11$, $SD = 0.35$) and in the conditions in which a 'no' response was indicated ($M = 1.11$, $SD = .35$), paired $t(183) = -0.05$, $p = .96$. This result stands in contrast to the previous work with this measure, where it is typically found that an affirmative answer is faster than a 'no' response (Dearing & Gotlib, 2009).

Study variables and demographic characteristics. Only data for participants who completed both Time 1 and Time 2 assessments were included in the analyses. Descriptive statistics for the symptom and interpretive bias variables are presented in Table 1. Table 2 contains the stressful life event data, including a breakdown of the frequency of life event occurrences for dependent and independent events.

The average level of current depressive symptoms reported on the BDI-II at Time 1 and Time 2 was somewhat higher than what is typically found in undergraduate samples (see Kendall & Sheldrick, 2000). At Time 1, 126 participants reported total scores on the BDI-II that reflected a level of depression in the minimal range (0-13

Table 1

Descriptive Statistics for Symptom and Interpretive Bias Variables

Variable	*n*	*M*	*SD*	Min	Max
BDI-II – Time 1	207	12.86	8.80	1	44
BDI-II – Time 2	207	12.69	9.96	0	55
IDD-L – Time 1	207	13.71	16.53	0	64
SST – Time 1					
No-Load Condition	207	0.23	0.22	0.00	0.90
Cognitive Load Condition[a]	180	0.24	0.23	0.00	0.82
AST – Time 1[b]					
Average RT for Positive Target Trials	184	0.96	0.25	0.51	1.72
Average RT for Negative Target Trials	184	1.10	0.29	0.64	1.94

Note. AST = Ambiguous Stories Task; BDI-II = Beck Depression Inventory – II; IDD-L = Inventory to Diagnose Depression – Lifetime Version; RT = Reaction Time (in seconds); SST = Scrambled Sentences Test

[a] Sample size varies for this measure because only participants who correctly recalled the 6-digit cognitive load number and who completed both assessments were included.

[b] Sample size varies for this measure because of participants who were excluded due to an unusually high number of errors, suggestive of difficulty comprehending the task requirements or inattentiveness during the task.

Table 2

Descriptive Statistics for Stressful Life Event Variables

Variable	*n*	%	*M*	*SD*	Min	Max
SLEQ total overall events – Time 2	207		10.28	10.86	0	129
SLEQ independent events – Time 2[a]	207		1.57	2.24	0	27
No. participants with 0	57	27.5				
No. participants with 1	67	32.4				
No. participants with 2	41	19.8				
No. participants with 3	23	11.1				
No. participants with 4	13	6.3				
No. participants with 5+	6	2.9				
SLEQ dependent events – Time 2[b]	207		6.91	7.69	0	88
No. participants with 0	7	3.4				
No. participants with 1	16	7.7				
No. participants with 2	26	12.6				
No. participants with 3	21	10.1				
No. participants with 4	23	11.1				
No. participants with 5	12	5.8				
No. participants with 6	19	9.2				
No. participants with 7	11	5.3				
No. participants with 8	17	8.2				
No. participants with 9	9	4.3				
No. participants with 10+	46	22.3				

Note. SLEQ = Stressful Life Experiences Questionnaire

[a] Out of a possible 34 events coded as independent of the participants' behaviour or actions.

[b] Out of a possible 105 events coded as at least partially dependent on the participants' behaviour or actions.

points); 36 reported scores in the mild range (14-19 points); 32 reported scores in the moderate range (20-28 points); and 13 reported scores in the severe range (29-63 points; Beck et al., 1996). Applying Dozois, Dobson, and Ahnberg's (1998) BDI-II cutoffs for the classification of undergraduate samples, 119 would be in the nondepressed category (BDI-II scores from 0-12), 43 would be in the dysphoric category (BDI-II scores from 13-19) and 45 would be in the dysphoric-depressed category (BDI-II scores from 20-63). At Time 2, similar numbers of participants fell into the BDI-II ranges as delineated above: 129 in the minimal range, 32 in the mild range, 33 in the moderate range, 13 in the severe range. There was not a significant difference in the average level of depressive symptoms reported from Time 1 to Time 2, paired $t(206) = 0.30$, $p = .76$. The average level of symptom severity as reported by the IDD-L in the current study was similar to that reported in other studies using undergraduate students (e.g., Goldston et al., 1990; Haaga, McDermut, & Ahrens, 1993).

Overall, participants solved a greater average number of sentences in the no-load condition of the SST ($M = 10.29$, $SD = 2.25$) than in the cognitive load condition ($M = 10.00$, $SD = 2.26$), paired $t(179) = -1.98$, $p < 0.05$. This finding is consistent with the assumption that the presence of a cognitive load should have increased the cognitive demands on the participants, thereby making it more difficult for them to descramble the sentences as quickly as in the no-load condition. The average negativity ratios on the cognitive load, $t(179) = 8.75$, $p < .001$, and no-load conditions, $t(206) = 8.09$, $p < .001$, were significantly higher compared to previous studies using these measures (e.g., Rude et al., 2002), and were more consistent with ratios of individuals who were subsequently diagnosed with a major depressive disorder after an 18 to 28 month interval (Rude et al.,

2003). Hence, the current sample and/or their responses to the interpretive bias measures captured by the negativity ratios of the SST in the current study may be different in some way from those previously examined in the literature.

As stated earlier, Time 1 BDI-II scores and Time 1 IDD-L scores were used as covariates in all analyses to control for baseline depressive symptoms and prior depression symptom severity, as is consistent with previous studies in this area (e.g., Cummings et al., 2010; Rude et al., 2002; Shih & Eberhart, 2010). To examine whether age, ethnicity, marital status, past diagnosis history, history of medication use, and/or history of therapy use were related to any of the pertinent study variables, appropriate preliminary tests were conducted. Please refer to Appendix I for the detailed outcomes of these statistical analyses. To minimize the number of covariates required in subsequent analyses to prevent residual confounding due to mismeasurement, preliminary tests to ascertain the most 'potent' or necessary variables were conducted (Christenfeld, Sloan, Carroll, & Greenland, 2004). In general, in any of the main analyses including IDD-L symptom scores as a covariate, self-reported diagnosis, medication, or therapy history were not also included as covariates. Based on the preliminary analyses, the following covariates were used in conjunction with the main study variables in statistical analyses: (a) age, marital status, and ethnicity were covariates with negativity ratio for the no-load condition on the SST; (b) self-reported diagnosis, therapy, and medication history were covariates with Time 1 IDD-L scores and Time 2 BDI-II scores (and were used only as covariates when IDD-L scores were not also used as a covariate); (c) self-reported therapy history was a covariate with Time 1 BDI-II scores (and was used only when IDD-L scores were also not included as a covariate); and (d) diagnosis history was a

covariate with SST ratios for the no-load and cognitive load conditions (and was used as a covariate only when general psychological distress history, as assessed by the IDD-L, was included as an additional covariate).

Correlations among study variables. Bivariate and partial correlations (where applicable), controlling for any relevant covariates as described previously, were calculated for all study variables (see Table 3). The bivariate correlations between the baseline measures of interpretive bias ranged from |.05| to |.09| across interpretive bias tasks (i.e., AST versus SST indices) and from |.58| to |.80| within interpretive bias tasks (i.e., different indices from the AST or SST). Once age, marital status, ethnicity (for SST no-load condition), and diagnosis self-reported diagnosis history (for both SST no-load and cognitive load conditions) were controlled for, the magnitude of these associations shifted slightly (see upper diagonal in Table 3). Previous studies using similar interpretive bias measures have noted significant associations among measures (e.g., r = .13, $p < .001$; Eley et al., 2008) and between different indices from the same measure (e.g., r = -.28, $p < .05$; Hindash & Amir, 2012). Of note, the negativity ratios on the SST cognitive load and no-load conditions typically correlate anywhere between r = .67 and r = .74 (Rude et al., 2002, 2003). Overall, the pattern of correlations in the current study suggested that the different measures of interpretive bias represented conceptually related, but empirically distinct constructs.

The magnitude of the correlation observed between independent and dependent life events in the current study (r = .79) was consistent with other stress generation studies that have utilized questionnaire-based life event assessment (e.g., r = .76, Hankin et al., 2010; r = .80, Sahl et al., 2009). Although these indexes are statistically related in

Table 3

Bivariate and Partial Correlations Between Depressive Symptoms, Interpretive Bias Measures, and Stressful Life Event Variables

Variable	1.	2.	3.	4.	5.
1. BDI-II – Time 1	--	.64***	.32***	.42***	.41***
2. BDI-II – Time 2	.66***	--	.28***	.42***	.40***
3. IDD-L	.34***	.36***	--	.20**	.18*
4. SST – No-Load Condition	.43***	.41***	.20**	--	.57***
5. SST – Load Condition[a]	.42***	.41***	.22***	.58***	--
6. AST – Average RT Positive[b]	.02	-.09	.04	.06	.08
7. AST – Average RT Negative[b]	-.10	-.14	-.02	-.09	-.05
8. SLEQ Total – Time 2	.11	.36***	.08	.23***	.10
9. SLEQ Independent – Time 2	.07	.30***	.07	.22**	.08
10. SLEQ Dependent – Time 2	.11	.36***	.08	.23***	.10

Note. AST = Ambiguous Stories Task; BDI-II = Beck Depression Inventory – II; IDD-L = Inventory to Diagnose Depression – Lifetime Version; RT = Reaction Time (in seconds); SST = Scrambled Sentences Test; SLEQ = Stressful Life Experiences Questionnaire.

Note. Bivariate correlations are on the lower diagonal; partial correlations are on the upper diagonal. Partial correlations with Time 1 BDI-II covaried out the effects of participants' self-reported diagnosis history. Partial correlations with Time 2 BDI-II covaried out the effects of participants' self-reported diagnosis, therapy, and medication history. Partial correlations with IDD-L covaried out the effects of participants' self-reported diagnosis, therapy, and medication history. Partial correlations with SST no-load condition covaried out the effects of participants' self-reported age, marital status, ethnicity, and diagnosis history. Partial correlations with SST cognitive load condition covaried out the effects of participants' self-reported diagnosis history.

[a] Only included the participants who correctly recalled the 6-digit remember load number for the purposes of all analyses in this paper (n = 180).

[b] Only included the participants who were not excluded because of an unusually high error rate (n = 184).

*p < .05; **p < .01; ***p < .001

Table 3 continued

Bivariate and Partial Correlations Between Depressive Symptoms, Interpretive Bias Measures, and Stressful Life Event Variables

Variable	6.	7.	8.	9.	10.
1. BDI-II – Time 1	.03	-.10	.11	.07	.11
2. BDI-II – Time 2	-.11	-.15*	.38***	.31***	.37***
3. IDD-L	.04	-.03	.09	.08	.08
4. SST – No-Load Condition	.06	-.09	.24***	.23**	.24**
5. SST – Load Condition[a]	.09	-.04	.10	.08	.11
6. AST – Average RT Positive[b]	--	.80***	-.02	-.01	-.03
7. AST – Average RT Negative[b]	.80***	--	-.10	-.07	-.10
8. SLEQ Total – Time 2	-.02	-.10	--	.87***	.98***
9. SLEQ Independent – Time 2	-.01	-.07	.87***	--	.79***
10. SLEQ Dependent – Time 2	-.03	-.10	.98***	.79***	--

Note. AST = Ambiguous Stories Task; BDI-II = Beck Depression Inventory – II; IDD-L = Inventory to Diagnose Depression – Lifetime Version; RT = Reaction Time (in seconds); SST = Scrambled Sentences Test; SLEQ = Stressful Life Experiences Questionnaire.

Note. Bivariate correlations are on the lower diagonal; partial correlations are on the upper diagonal. Partial correlations with Time 1 BDI-II covaried out the effects of participants' self-reported diagnosis history. Partial correlations with Time 2 BDI-II covaried out the effects of participants' self-reported diagnosis, therapy, and medication history. Partial correlations with IDD-L covaried out the effects of participants' self-reported diagnosis, therapy, and medication history. Partial correlations with SST no-load condition covaried out the effects of participants' self-reported age, marital status, ethnicity, and diagnosis history. Partial correlations with SST cognitive load condition covaried out the effects of participants' self-reported diagnosis history.

[a] Only included the participants who correctly recalled the 6-digit remember load number for the purposes of all analyses in this paper (n = 180).

[b] Only included the participants who were not excluded because of an unusually high error rate (n = 184).

*p < .05; **p < .01; ***p < .001

the current study, they are conceptually different according to stress generation theory (Hammen, 1991, 2006). In fact, previous researchers have suggested that vulnerable individuals may live in family contexts and choose friends that increase their risk of both dependent life *and* independent life events (e.g., family member's poor health; Harkness & Stewart, 2009). Hence, if broader social circumstances contribute to independent life events beyond the individual's control, they may also increase the risk of dependent life events within that same environment.

Question 1 - Does Interpretive Bias Predict Changes in Depressive Symptoms?

The first objective of this study was to explore whether interpretive biases, as measured by the SST and AST, were related to concurrent depressive symptoms and depression symptom history at Time 1, and if they predicted increases in depressive symptoms at Time 2. More specifically, concurrent depressive symptoms and depression symptom history were expected to be related to a greater proportion of negative sentences constructed on the SST and to faster response latencies for negative story endings (and slower reactions times for benign or positive story endings) on the AST. Furthermore, a higher proportion of negative sentences constructed on the SST no-load and cognitive load conditions, as well as faster response latencies for negative story endings and slower response latencies for benign or positive story endings on the AST, were hypothesized to predict greater increases in depressive symptoms over the 5-week period.

Bivariate and partial correlations were used to investigate the concurrent relationship among interpretive bias and Time 1 depressive symptom measures. Consistent with hypotheses, negativity ratios on the SST for both the no-load and cognitive load conditions were significantly related to higher scores on the BDI-II and

IDD-L at Time 1, both with and without covariates. Contrary to hypotheses, neither the average reaction time for positive target trials nor the average reaction time for negative target trials on the AST, were significantly related to Time 1 BDI-II scores or Time 1 IDD-L scores, with or without demographic covariates.

Hierarchical linear regression analyses controlling for demographic covariates (i.e., age and marital status, where applicable), as well as Time 1 BDI-II and IDD-L, were used to examine whether baseline interpretive bias factors predicted depressive symptoms at five-week follow-up. In the first step, demographic covariates related to the criterion variable or interpretive bias predictor variable were entered, where applicable (see Tables 4 through 7).[7] In all instances, Time 1 depressive symptomatology (BDI-II scores) and Time 1 depressive symptom history (IDD-L scores) predicted Time 2 BDI-II significantly. In the final step, the interpretive bias variables were entered individually in a series of separate regressions predicting Time 2 depression.

Results indicated that negativity ratios for both the no-load[8] and cognitive load conditions on the SST (*p*s < .05) significantly predicted follow-up depressive symptoms, as did the average reaction time for positive target trials on AST ($p < .05$). Consistent with hypotheses, higher negativity ratios (i.e., higher proportion of scrambled sentences solved in a negative way, relative to the total number of sentences solved) on the SST predicted increased levels of depressive symptoms at Time 2, over and above baseline covariates and Time 1 symptoms. In contrast to expectations, faster average reaction

[7] No demographic covariates were necessary in the analyses contained in Tables 5 through 7, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

[8] The pattern of results was identical in analyses conducted without any demographic covariates included (Simmons et al., 2011).

Table 4

Hierarchical Linear Regression Prospectively Predicting Depressive Symptoms from Negativity Ratio on SST No-Load Condition

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1: Demographic Covariates	1.03	1.03	.12	.02	3, 199				
Age						-0.43	0.36	-.13	-1.20
Marital Status						2.90	4.45	.07	0.65
Ethnicity						0.54	0.43	.09	1.28
Step 2: Baseline Depression	46.30***	112.47***	.74	.52	2, 197				
BDI-II – Time 1						0.73	0.06	0.66	12.67***
IDD-L						0.08	0.03	0.14	2.66*
Step 3: Interpretive Bias Variable – SST	40.64***	6.21*	.74	.01	1, 196				
No-Load Condition						5.94	2.38	0.14	2.49*

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; SST = Scrambled Sentences Test

*$p < .05$; **$p < .01$; ***$p < .001$

Table 5

Hierarchical Linear Regression Prospectively Predicting Depressive Symptoms from Negativity Ratios on SST Cognitive Load Condition

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1: Baseline Depression	86.39***	86.39***	.71	.50	2, 172				
BDI-II – Time 1						0.69	0.06	0.65	11.49***
IDD-L						0.07	0.03	0.13	2.28*
Step 3: Interpretive Bias Variable – SST	63.23***	8.93**	.73	.02	1, 171				
Cognitive Load Condition						6.66	2.23	0.17	2.99**

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; SST = Scrambled Sentences Test

*$p < .05$; **$p < .01$; ***$p < .001$

Table 6

Hierarchical Linear Regression Prospectively Predicting Depressive Symptoms from Average Reaction Time for Positive Target Trials on the Ambiguous Stories Task

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1: Baseline Depression	104.57***	104.57***	.73	.54	2, 179				
BDI-II – Time 1						0.77	0.06	0.66	12.28***
IDD-L						0.09	0.03	0.16	3.00**
Step 2: Interpretive Bias Variable – AST	72.93***	4.99*	.74	.01	1, 178				
Average RT for Positive Target Trials						-4.40	1.97	-0.11	-2.23*

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; RT = Reaction Time

*$p < .05$; **$p < .01$; ***$p < .001$

Table 7

Hierarchical Linear Regression Prospectively Predicting Depressive Symptoms from Average Reaction Time for Negative Target Trials on the Ambiguous Stories Task

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1: Baseline Depression	109.42***	109.42***	.74	.55	2, 177				
BDI-II – Time 1						0.75	0.06	0.66	12.44***
IDD-L						0.10	0.03	0.18	3.32**
Step 2: Interpretive Bias Variable – AST	74.93***	3.21†	.75	.01	1, 176				
Average RT for Negative Target Trials						-2.93	1.64	-0.09	-1.79†

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; RT = Reaction Time

$^{\dagger}p = .07$; *$p < .05$; **$p < .01$; ***$p < .001$

times on AST test trials that were completed with a positive ending were also predictive of higher levels of depressive symptomatology at Time 2, over and above the effects of Time 1 symptoms. There was also a trend-level effect for average reaction time for negative target trials on the AST (p = .07). This trend was in the direction hypothesized; faster average reaction times on AST test trials completed with a negative ending were predictive of higher levels of depressive symptomatology at Time 2, above and beyond the effects of Time 1 symptoms.[9]

Question 2 - Does Interpretive Bias Predict Stress Generation?

The second primary objective was to examine interpretive bias for ambiguous social information as a contributor to stress generation. Generally, interpretive bias was expected to uniquely predict the occurrence of dependent life events, and be unrelated to the frequency of independent life events reported by participants. Specifically, a higher proportion of negative sentences constructed on the SST, as well as faster response latencies for negative story endings and slower response latencies for benign or positive story endings on the AST, were hypothesized to predict the occurrence of more life stressors at least partially dependent on participants' behaviours (i.e., dependent events) by Time 2. The indices of interpretive bias were not expected to be predictive of the occurrence of fateful stressors (i.e., independent events).

Four sets of negative binomial regression analyses were conducted to test whether interpretive bias would predict dependent life stress, but not independent life stress, over the 5-week follow-up. In each regression analysis, dependent and independent life stress

[9] Inclusion of all observations (n = 207) resulted in a similar pattern of results, with a greater degree of statistical significance across all variables.

variables were regressed onto relevant demographic characteristic covariates (where applicable), baseline BDI-II symptoms, and baseline IDD-L symptoms all entered in the same step. In a second iteration of the models, an individual interpretive bias variable was separately added to the model and the incremental gain in prediction was compared against the initial model that did not include the interpretive bias variable.

Please refer to Appendix J for a detailed explanation of how model fit and gain in prediction were examined in the negative binomial regression models. Appendix J also contains the summary tables (Tables A through C) of the baseline negative binomial models for the prediction of independent and dependent life stress from relevant demographic covariates and baseline depressive symptoms and depression history. The omnibus test (i.e., the $LR\ \chi^2$) for all of these analyses was statistically significant, indicating that individual regression coefficients should be inspected to determine whether any variables were significant predictors of independent and dependent life events. In each set of negative binomial regression models, Time 1 depressive symptom scores assessed by the BDI-II were significant predictors of both independent and dependent life events reported at Time 2. Specifically, for each point increase in the participants' BDI-II scores at Time 1 (e.g., from a total symptom score of 0 to 1), participants were expected to report 1.02 *times* as many independent *and* dependent life events at Time 2. No other demographics or clinical covariates were significant predictors of the frequency of independent and dependent life events reported at Time 2.

The critical test of stress generation compares the relative gain in prediction of independent and dependent life stress by adding in the various interpretive bias variables. The comparison of the baseline model (e.g., model with all covariates and baseline

control variables) versus the model with the addition of an interpretive bias variable (Table 8) yields this information. According to stress generation theory, factors that increase vulnerability to stress generation should uniquely relate to dependent, but not independent, life stress (Hammen, 2006; Liu & Alloy, 2010). As can be seen in Table 8, the average reaction times for positive trials on the AST uniquely and significantly improved prediction for dependent life stress, but not independent life stress, according to both the Akaike's information criterion (AIC) and the Bayesian information criterion (BIC). Specifically, the model including the average reaction times for positive trials on the AST had a lower AIC and BIC than that of the model that did not contain this additional predictor (e.g., model containing baseline depressive symptoms and depression history), suggesting that the inclusion of the AST variable significantly improved prediction of the occurrence of dependent life stress, but not the prediction of independent life stress. A participant with an average reaction time score of 0.00 seconds to positive target trials would be expected to report 0.59 *times* as many dependent life events as a participant with an average reaction time of 1.00 seconds. In other words, faster responses to ambiguous stories completed with a positive ending were associated with greater numbers of dependent life events. In contrast, in the model containing the average reaction times for negative trials on the AST, as well as the models for the SST negativity ratios for the no-load and cognitive load conditions, there was no evidence that the interpretive bias variables contributed significantly to the prediction of the outcome. There was no evidence from decreases in the AIC or BIC scores for an improvement in prediction, and the *z*-tests for the individual interpretive bias indices did not indicate significant prediction, despite the statistically significant

Table 8

Negative Binomial Models Predicting Life Stress from Interpretive Bias Variables

Model	IRR (95% C.I.)	*z*	*LR* χ^2	AIC	BIC
Predicted Outcome: Rate ILS					
SST Negativity - No Load[a, 10]	1.37 (0.72-260)	0.97	16.24*	548.51	675.09
SST Negativity - Cognitive Load[b]	0.80 (0.40-1.58)	-0.64	8.18*	554.84	570.74
AST Mean RT for Positive Trials[c]	0.69 (0.40-1.20)	-1.32	12.35**	579.02	595.04
AST Mean RT for Negative Trials[c]	0.83 (0.52-1.33)	-0.77	11.18*	580.18	596.20
Predicted Outcome: Rate DLS					
SST Negativity - No Load[a, 10]	1.25 (0.74-2.12)	0.82	25.44***	1151.13	1177.71
SST Negativity - Cognitive Load[b]	1.05 (0.62-1.78)	0.18	12.41**	988.79	1004.70
AST Mean RT for Positive Trials[c]	0.59 (0.38-0.92)	-2.31*	21.00***	**1020.66**	**1036.68**
AST Mean RT for Negative Trials[c]	0.81 (0.56-1.16)	-1.14	17.06***	1024.60	1040.62

Note. Each row represents a separate model for the prediction of frequency of life stressors. To avoid redundancy, the relevant statistics for the necessary covariates included in each model (i.e., as described in Tables A through C in Appendix J, e.g., age, baseline depression) are not shown. $z = b/SE$. IRR = incidence rate ratio (i.e., the exponentiated unstandardized regression coefficient, e^b). *LR* = likelihood ratio. AIC = Akaike's information criterion. BIC = Bayesian information criterion. ILS = independent life stress. DLS = dependent life stress. SST = Scrambled Sentences Test. AST = Ambiguous Stories Task. AIC and BIC values in **bold** are those that are less than the values obtained from the model containing only the covariates and control variables (see Tables A through C in Appendix J for the relevant AIC and BIC for each interpretive bias variable model).

[a] $n = 205$, $df = 8$ for *LR* χ^2; [b] $n = 178$, $df = 5$ for *LR* χ^2; [c] $n = 182$, $df = 5$

*$p < .05$; **$p < .01$; ***$p < .001$

[10] The pattern of results was identical in analyses conducted without any demographic covariates included.

omnibus tests for all models ($LR\ \chi^2$).[11] This suggests that the models including the interpretive bias variables were equally as predictive of Time 2 stressors, as the more simplified models containing only the relevant demographic covariates and baseline depressive symptomatology and depression symptom history; the inclusion of interpretive bias variables did not provide increased prediction in the outcome variable.

Question 3 - Does Interpretive Bias Interact With Stressful Life Events to Predict Changes in Depressive Symptoms?

The third, and final, objective of this study was to examine interpretive bias within the context of a diathesis-stress framework (interactional/moderation model; Beck, 1987). Moderation hypotheses were tested according to Baron and Kenny's (1986) guidelines. Consistent with Friedrich's procedure (1982), the cross-product of the standardized independent variables was used as the interaction term, and all independent and dependent variables were standardized. This study examined whether individuals high in certain interpretive biases would experience higher levels of depressive symptoms in response to dependent life events, as compared to individuals with lower levels of these variables. If this model fits the data, the variance in depressive symptoms accounted for by the interaction term would be significant, even after controlling for the main effects of the interpretive bias variable and dependent life stress over a five-week period. In particular, participants who solved a higher proportion of sentences with negative

[11] Inclusion of all observations (n = 207) resulted in a similar pattern of results. The differences in these analyses (including the 2 participants with extreme responding patterns on the SLEQ) were that the significant effect of AST positive trials on dependent life stress fell to trend-level (p = .064), the effect of SST cognitive load condition on dependent life stress increased to trend-level (p = .065), and SST no-load condition significantly predicted both independent and dependent life stress (p < .001).

solutions on the SST, and participants who displayed faster response latencies for negative story endings and slower response latencies for benign or positive story endings on the AST, in the context of higher frequencies of life events, were hypothesized to be at the most elevated risk for increases in depressive symptoms, compared to participants with lower frequencies of life events or more positive patterns of interpretive bias.

A series of hierarchical linear regression analyses were used to examine the interaction between *each* baseline interpretive bias variable and dependent stress, predicting BDI-II at five-week follow-up. For each linear regression equation, the standardized version of each interpretive bias variable, dependent stress, and the interaction between interpretive bias variable and dependent stress (controlling for baseline BDI-II, IDD-L, and independent life stress) were entered (see Tables 9 through 12 for a list of the interpretive bias indices variables used in the separate equations). Consistent with earlier analyses, baseline depressive symptoms, previous depressive symptom history, independent life events, and dependent life events were significant predictors of depressive symptoms at follow-up. Additionally, negativity ratios for the no-load and cognitive load conditions from the SST, but not average reaction times for trials from the AST, were significant predictors of Time 2 BDI-II scores even after controlling for other symptom and life event variables. In contrast to expectations, none of the four interpretive bias variables was a significant predictor of depressive symptoms in interaction with dependent stress ($p > .05$), when the main effects, baseline BDI-II, baseline IDD-L and independent life stress were controlled for statistically.[12]

[12] As per Simmons et al.'s (2011) recommendations, these analyses were also re-conducted without any demographic covariates or including all observations ($n = 207$). The pattern of results was identical to those reported above and below.

Table 9

Diathesis-Stress (Moderation) Analyses Predicting Depressive Symptoms: SST Negativity No-Load Condition

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1:	1.14	1.14	.13	.02	3, 198				
Age						-0.05	0.04	-0.15	-1.40
Marital Status						0.38	0.47	0.09	0.82
Ethnicity						0.05	0.04	0.09	1.22
Step 2:	41.85***	81.17***	.75	.55	3, 195				
BDI-II – Time 1						0.62	0.05	0.62	12.16***
IDD-L						0.12	0.05	0.12	2.43*
SLEQ Independent Life Stress						0.28	0.05	0.28	5.83***
Step 3:	35.50***	7.76***	.77	.03	2, 193				
SST No-Load Condition						0.12	0.05	0.12	2.18*
SLEQ Dependent Life Stress						0.24	0.08	0.24	3.11**
Step 4:	31.93***	1.96	.77	.00	1, 192				
SST No-Load x SLEQ Dependent						-0.06	0.04	-0.11	-1.40

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; SST = Scrambled Sentences Test; SLEQ = Stressful Life Experiences Questionnaire

*$p < .05$; **$p < .01$; ***$p < .001$

Table 10

Diathesis-Stress (Moderation) Analyses Predicting Depressive Symptoms: SST Negativity Cognitive Load Condition

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1: [13]	78.78***	78.78***	.76	.58	3, 172				
BDI-II – Time 1						0.63	0.05	0.63	11.97***
IDD-L						0.13	0.05	0.13	2.54*
SLEQ Independent Life Stress						0.31	0.05	0.31	6.18***
Step 2:	55.10***	8.83***	.79	.04	2, 170				
SST Cognitive Load Condition						0.13	0.05	0.13	2.47*
SLEQ Dependent Life Stress						0.27	0.08	0.27	3.34**
Step 3:	45.66***	0.03	.79	.00	1, 169				
SST Load x SLEQ Dependent						-0.01	0.07	-0.01	-0.17

Note. BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; SST = Scrambled Sentences Test; SLEQ = Stressful Life Experiences Questionnaire

*$p < .05$; **$p < .01$; ***$p < .001$

[13] No demographic covariates were necessary in these analyses, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

Table 11

Diathesis-Stress (Moderation) Analyses Predicting Depressive Symptoms: AST Average Reaction Time for Positive Target Trials

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1:[14]	87.16***	87.16***	.77	.60	3, 177				
BDI-II – Time 1						0.63	0.05	0.63	12.34***
IDD-L						0.16	0.05	0.16	3.12**
SLEQ Independent Life Stress						0.29	0.05	0.29	6.00***
Step 2:	58.00***	6.35**	.79	.03	2, 175				
Average RT for Positive Target Trials						-0.08	0.05	-0.08	-1.67
SLEQ Dependent Life Stress						0.24	0.08	0.24	3.01**
Step 3:	48.18***	0.29	.79	.00	1, 174				
AST Positive x SLEQ Dependent						0.05	0.09	0.3	0.54

Note. AST = Ambiguous Stories Task; BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; RT = Reaction Time; SLEQ = Stressful Life Experiences Questionnaire

*$p < .05$; **$p < .01$; ***$p < .001$

[14] No demographic covariates were necessary in these analyses, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

Table 12

Diathesis-Stress (Moderation) Analyses Predicting Depressive Symptoms: AST Average Reaction Time for Negative Target Trials

Step and variable entered	*F*	Δ*F*	*R*	ΔR^2	*df*	*B*	*SE* of *B*	β	*t*
Step 1:[15]	87.16***	87.16***	.77	.60	3, 177				
BDI-II – Time 1						0.63	0.05	0.63	12.34***
IDD-L						0.16	0.05	0.16	3.12**
SLEQ Independent Life Stress						0.29	0.05	0.29	6.00***
Step 2:	57.90***	6.25**	.79	.03	2, 175				
Average RT for Negative Target Trials						-0.08	0.05	-0.08	-1.61
SLEQ Dependent Life Stress						0.24	0.08	0.24	3.10**
Step 3:	47.98***	0.01	.79	.00	1, 174				
AST Negative x SLEQ Dependent						-0.01	0.07	-0.01	-0.12

Note. AST = Ambiguous Stories Task; BDI-II = Beck Depression Inventory-II; IDD-L = Inventory to Diagnose Depression, Lifetime Version; RT = Reaction Time; SLEQ = Stressful Life Experiences Questionnaire

*$p < .05$; **$p < .01$; ***$p < .001$

[15] No demographic covariates were necessary in these analyses, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

Discussion

The purpose of this study was to investigate interpretive bias for ambiguous social information within the context of stress and depression. Two-hundred-and-seven young women participated in a prospective study with a five-week period between the two assessment points. This study had several methodological advantages, including the utilization of multiple forms of assessment of interpretive bias using process-based measurement; multiple points of measurement of depressive symptoms and depression symptom history using well-validated instruments; and a comprehensive list of life events that was scored for independence and dependence by Ph.D.-level raters with experience in contextual rating systems. Importantly, this was the first study to explore interpretive bias in the context of life stress. This research is also the first to examine both stress generation and diathesis-stress models within the same sample as a way of integrating the information processing variable of interpretive bias, into the broader cognitive vulnerability literature.

Does Interpretive Bias Predict Changes in Depressive Symptoms?

To begin with, two measures of interpretive bias—the SST and AST—were examined in relation to concurrent depressive symptoms and depression history. Consistent with hypotheses, negativity ratios on the SST in the cognitive load and no-load conditions were significantly related to Time 1 depressive symptoms and Time 1 self-reported history of depression. Specifically, increased negativity ratios (i.e., greater negative interpretive bias) for the load and no-load conditions were related to higher BDI-II symptoms and greater lifetime depression symptom endorsement on the IDD-L. These results are consistent with previous studies that have examined the SST in relation

to concurrent depression (Rude et al., 2002, 2003). Contrary to expectations, average RTs for positive and negative target trials on the AST were unrelated to either concurrent depressive symptoms or depression history at Time 1. This finding is consistent with previous work that has shown that RTs on this task are not contingent on participant's past or current mental disorder, but instead may distinguish participants in their vulnerability to subsequent depression (e.g., risk status as the daughter of a mother with a history of depression versus the daughter of a never-disordered mother; Dearing & Gotlib, 2009). This finding is also consistent with many of the negative results of researchers who have used reaction time indices with non-self-referential stimuli (Bisson & Sears, 2007; Lawson & MacLeod, 1999; Mogg et al., 2006). However, RTs on the AST, while not related to depression concurrently, may predict depression over time or predict the stressors which subsequently lead to later depression.

Beyond concurrent relationships, the extent to which interpretive biases predicted changes in depressive symptoms over the 5-week follow-up was also examined. Consistent with expectation, the results demonstrated that three of the four indices of interpretive bias were significantly predictive of Time 2 depression symptoms, over and above the effects of baseline covariates and Time 1 symptoms. As would be expected, higher negativity ratios on the SST cognitive load and no-load conditions predicted increases in depressive symptomatology over the follow-up interval. Thus, increased negative bias in the interpretation of ambiguity was related to changes in depressive symptoms over the 5-week period. This finding suggests that negative interpretive bias may be a risk factor for the development of depression, and is consistent with previous studies that have shown that interpretive bias can predict negative shifts in mood (Wisco

& Nolen-Hoeksema, 2010, 2011), changes in depressive symptoms (Rude et al., 2002), and the eventual onset of major depressive episodes (Rude et al., 2003, 2010).

These results provide additional support for the theoretical claim of cognitive models of depression that information processing biases—in this case, biases in resolving ambiguous social information—predict subsequent symptoms of depression (Beck, 1964; D. A. Clark et al., 1999). Importantly, these results were obtained while controlling for concurrent depressive symptoms (Time 1 BDI-II scores) *and* reported worst lifetime symptoms of depression (Time 1 IDD-L scores). This finding is significant, given that prior depression is the single best predictor of subsequent depression (e.g., Hankin et al., 1998; Harrington et al., 1990; Lewinsohn et al., 1989; Rao et al., 1999). These results suggest the importance of the presence of a negative processing bias in predicting subsequent depression. Moreover, scores on the SST did predict changes in depressive symptoms, despite the fact that a relatively short follow-up period was used. This finding suggests that a theoretically significant role exists for interpretive biases in depression vulnerability. Further, it provides additional rationale for the importance of therapeutic efforts, through CBM-I (e.g., Blackwell & Holmes, 2010; Holmes et al., 2009) and cognitive behavioural therapy (Beck & Dozois, 2011), to modify interpretive bias to treat and/or prevent the onset and recurrence of MDE.

At the same time, one cannot conclude definitively that these interpretive biases caused subsequent depressive symptoms. For instance, the results may have been impacted by remnant "scars" from previous experiences with dysphoria and depression (Lewinsohn et al., 1981; Rohde, Lewinsohn, & Seeley, 1990; Zeiss & Lewinsohn, 1988). According to the "scar" hypothesis, depression may remit but leave psychological scars,

such as negative cognitive patterns, that were not present prior to the depressive episode and therefore could not have caused it in the first place. Unfortunately, almost all studies that have examined this hypothesis in depression have failed to find evidence of scars despite the theoretical and conceptual logic for the existence of them (for review, see Wichers, Geschwind, van Os, & Peeters, 2010). In the current study, interpretive biases would not be expected to add uniquely to the prediction of subsequent depression symptoms if they were simply the result of past experiences of dysphoria or depression, especially given that the most powerful predictors of depression – concurrent and worst lifetime symptom reports – were statistically controlled for in earlier steps of the analyses (e.g., Hankin et al., 1998; Harrington et al., 1990; Lewinsohn et al., 1989; Rao et al., 1999). Hence, the results found may provide important information about the role of interpretive bias in depression risk.

These results could also be suggestive of a common causal risk factor for both interpretive bias and depression. One such third factor could be the personality or temperamental predisposition of neuroticism or negative affectivity/negative emotionality (Mathews & MacLeod, 2005). Individuals high on neuroticism are more emotionally reactive; have a proclivity for experiencing negative mood states, such as anxiety, depression, and anger; have difficulty regulating their negative emotional reactions; and may interpret ordinary situations in a threatening manner (e.g., Costa & McCrae, 1992; Espejo et al., 2011; H. J. Eysenck, 1970). Indeed, by its very definition, the personality disposition of neuroticism can be manifested as a cognitive process (M. Martin, 1985). Research examining other forms of information processing biases (e.g., attention, memory) have found support for the association between neuroticism and cognitive

biases (e.g., Chan et al., 2007; M. Martin, Ward, & Clark, 1983; Reed & Derryberry, 1995; Ruiz-Caballero & Bermúdez, 1995). In the two studies that have examined personality and interpretive bias, results have been mixed (Dodd, Hudson, Morris, & Wise, 2012; Muris, Meesters, & Rompelberg, 2007), but there is the suggestion that personality may be positively associated with interpretive bias in child samples. Furthermore, recent research demonstrates that cognitive factors may be a proximal-specific mechanism mediating the relationship between distal temperamental vulnerabilities and depression (e.g., Barnhofer & Chittka, 2010; Hong & Paunonen, 2011; Kercher, Rapee, & Schniering, 2009; Lakdawalla & Hankin, 2008). Hence, it may be the case that interpretive bias is one such mediator variable in this type of relationship. At the same time, current research examining the distinctness and independent contribution of personality traits and cognitive vulnerability factors to depression supports the notion that they are separate, distinguishable and not a theoretically overlapping, single generic vulnerability to depression (L. A. Clark, Watson, & Mineka, 1994; Hankin, Fraley, & Abela, 2005; Hankin, Lakdawalla, Carter, Abela, & Adams, 2007; Zuroff, Mongrain, & Santor, 2004). Future studies should examine the relationship between temperament/personality vulnerabilities and interpretive bias in adult samples to gain a better understanding of their unique and combined influences in the development of depression.

Interestingly, *faster* average reaction times on positive AST trials were related to higher levels of depressive symptoms at Time 2, above and beyond the effects of covariates and Time 1 symptoms. This result suggests that individuals vulnerable to depression have enhanced processing of ambiguous information, such as social stories

that resolve in a positive manner, and hence may be quicker to resolve the ambiguity in a positive way. The direction of this result was opposite to what was predicted, based on the hypothesis that participants should be slower to response to positive endings which are inconsistent with their negatively biased interpretation of the scenarios (Dearing & Gotlib, 2009; MacLeod & Cohen, 1993). Follow-up analyses, examining general information processing tendencies on this measure, revealed that participants were somewhat atypical in their response patterns compared to previous work using this measure (e.g., Dearing & Gotlib, 2009).

Similarly, the apparent facilitated processing of positive story endings in those individuals who went on to experience increases in depressive symptoms is inconsistent with previous work on interpretive biases (e.g., Lawson & MacLeod, 1999; Sears et al., 2011) and other information processing tendencies in depression (e.g., Azorin, Benhaïm, Hasbroucq, & Possamaï, 1995; Bruder, Yozawitz, Berenhaus, & Sutton, 1980; D. G. Byrne, 1976; Siegle, Granholm, Ingram, & Matt, 2001). Specifically, depression is associated with a general slowing of reaction times to execute voluntary responses (Azorin et al., 1995; Bruder et al., 1980) and greater variability in individuals' response latencies (D. G. Byrne, 1976). Hence, some researchers have suggested that reaction time indices may be insensitive to cognitive processing biases in depressed populations (Moretti et al., 1996). Furthermore, depression is more typically characterized by both a presence of negative biases *and* absence of protective biases that facilitate the processing of positive information (for review, see Trew, 2011). Hence, it may be the case that the current sample is anomalous and this result is uninterpretable, or that this statistically significant result is due to chance or Type I error.

This counterintuitive result also may be indicative of the variability and inconsistency related to examining interpretive bias in the context of depression. Numerous other studies have had difficulty finding expected relations between interpretive bias and depression, especially in studies that rely on reaction time indices (Bisson & Sears, 2007; Lawson & MacLeod, 1999; Mogg et al., 2006; Sears et al., 2011). This may be because individuals currently in a dysphoric state demonstrate repressor effects or attempts at mood repair when faced with ambiguous social information (Creswell & Myers, 2002; Kovacs, Rottenberg, & George, 2009; Weinberger, Schwartz, & Davidson, 1979). For example, those individuals with a repressive coping style (repressors) tend to avoid negative affect. As a result, direct self-report measures may not be able to elicit accurate information about interpretive bias from individuals with this tendency (see Myers, 2000, for a review) and reaction time measures may be systematically biased towards increased latencies for repressors (e.g., Weinberger et al., 1979). However, if mood repair or repressor effects were impacting these results participants would display *longer* rather than shorter reaction times in relation to depressive symptoms (Detweiler-Bedell & Salovey, 2003; Joormann & Siemer, 2004; Josephson, 1996; Rusting & DeHart, 2000; Weinberger et al., 1979).

These findings, together with the results of other studies that have failed to support the validity of reaction time based assessment, suggest that alternate methods for assessing interpretive bias may be necessary. One potential avenue that has recently been investigated is differential error rates in response to positive and negative targets (Sears et al., 2011) and psychophysiological correlates of interpretive bias (Lawson et al., 2002). Future studies, using multiple indices of interpretive bias, are needed to determine under

what circumstances reaction times provide a good indicator of interpretation of ambiguity tendencies.

Does Interpretive Bias Predict Stress Generation?

Interpretive bias was also examined as a contributor to the generation of dependent, but not independent, life stress. Because of the strong relationship between previous experiences of depression and stress generation (e.g., Davila et al., 1995; Hammen, 1991; Potthoff et al., 1995), all analyses statistically controlled for Time 1 depressive symptoms and Time 1 depression history to eliminate the potential of confound due to mood-congruent effects of depression on memory. This analytic strategy provided a powerful way to test the unique contribution of interpretive bias on stress generation beyond any effects of depression.

The current study found evidence for a role of interpretive bias in stress generation. In particular, facilitated processing of positive endings to ambiguous stories (i.e., faster reaction times) was associated with increases in the occurrence of dependent life stressors, but not independent life stressors. This result was found, even after controlling for the significant influence of past depression symptom history and baseline depressive symptoms. This finding suggests that individuals' tendencies in reacting to positive story endings were related to an increase in reporting subsequent dependent life events, preferentially, over the 5-week study interval. This facilitation for processing of positive story endings stands in opposition to what was originally hypothesized and may be due to anomalies with this particular index of interpretive bias (see discussion in previous section about potential challenges with this index of interpretive bias and the possibility of Type I error). It also contrasts the general body of literature supporting

compromised information processing of positively-valenced affective material in those at-risk for depression and those currently depressed (e.g., Joormann & Gotlib, 2006, 2007; Joormann, Talbot, & Gotlib, 2007; Suslow, Junghanns, & Arolt, 2001), who may also be at-risk for stress generation by virtue of that same information processing vulnerability.

At the same time, if this result is replicable, it presents a novel finding that may be related to research demonstrating that dysphoric individuals are particularly vigilant in their social-information processing (Weary & Edwards, 1994; Yost & Weary, 1996). In the current sample, facilitated reaction times to positive story endings could be one manifestation of motivated information-seeking and -processing required for the enhanced ability to draw inferences following ambiguous social information in those who may be dysphoric or at-risk for depression (Harkness, Jacobson, Sinclair, Chan, & Sabbagh, 2011; Harkness, Sabbagh, Jacobson, Chowdrey, & Chen, 2005). In contrast to the hypothesized interference effect due to a greater tendency to make negative interpretations, it may be the case that faster response times for positive story endings represent an indicator of hypersensitivity to the personality and behaviour of others that enables them to more accurately decode their mental states. However, if this were the case, response facilitation to *all* valences of story endings (i.e., for both positive and negative story endings) would be expected, given a generalized social information processing hypervigilance. Theoretically, this hypersensitivity could inadvertently lead to dependent life stress through problematic interpersonal behaviours related to social-cognition that are already known to be related to stress generation and/or depression, such as excessive reassurance seeking and negative feedback seeking (Borelli & Prinstein,

2006; Evraire & Dozois, 2011; Joiner & Metalsky, 2001; Joiner, Metalsky, Katz, & Beach, 1999; Nepon, Flett, Hewitt, & Molnar, 2011; Pettit & Joiner, 2001; Potthoff et al., 1995; Shih & Eberhart, 2008, 2010). Future research should explore the possible associations between interpretive bias, theory of mind, and interpersonal behaviours to determine if the suggested pathways from interpretation of an ambiguous situation to stress generation are valid. Additionally, studies should examine the convergence and discrepancy between interpretive bias for positive and negative information to ascertain if and under what circumstances one or both relate to stress generation.

Alternately, this facilitation for positive story endings on the AST could be a manifestation of the perfectionistic tendency for facilitated information processing of stimuli that is not self-descriptive of the ideal-self (Hewitt & Genest, 1990). Individuals with high levels of self-criticism or perfectionism may have developed an expertise and heightened sensitivity for the ideal outcome to situations. Their interpretations of ambiguity may be coloured by this perspective of what they believe should happen. They may generate life stress inadvertently due to these overly self-critical or perfectionistic personality features, which result in difficulties in their interpersonal relationships (increased conflict, lack of social support) or academic/occupational functioning (trying to accomplish too much and becoming overloaded; Priel & Shahar, 2000; Shahar et al., 2004; Shahar & Priel, 2003). Future studies should examine the role of perfectionism and other personality factors to determine potential moderating and mediating relationships with interpretive bias and life stress.

In contrast, no additional evidence for a role of interpretive bias in stress generation was found. Instead, negative proportion scores for the no-load and cognitive

load conditions on the SST, as well as the reaction times for negative target trials on the AST, did not contribute additional prediction to either independent or dependent life stress. Contrary to hypotheses, there was no association between the tendency to unscrambled sentences in a negative manner or in facilitated processing of negative endings to ambiguous stories and the likelihood of experiencing stressful life events over the 5-week interval. However, this is consistent with the bivariate and partial correlations (see Table 3) which also suggest that these indices of interpretive bias may not all be related to life stress, especially once the impact of past depression history and baseline depressive symptoms were controlled for statistically (Rude et al., 2002). The lack of results for the other indices of interpretive bias as significant predictors of stress generation was somewhat surprising, given the extant empirical support for other cognitive factors (Abela & Hankin, 2011; Auerbach et al., 2010; Flynn et al., 2010; Kercher & Rapee, 2009; Safford et al., 2007; Shih et al., 2009; Simons et al., 1993). Upon closer inspection, the current study differed from previous work in that the sample consisted of undergraduate students and the method of life assessment was a self-report checklist. The majority of studies with affirmative results for the stress generation effect were conducted on younger adolescent samples, did not fully examine stress generation per se (e.g., tested on the prediction of general life stress and failed to differentiate/compare the prediction of dependent versus independent life events), or were over lengthy time periods (e.g., 1 year). Any of the previous studies with positive results in undergraduate samples used an interview measure of life events and were conducted over a much longer time interval (e.g., 27 months, Flynn et al., 2010; 6 months, Safford et al., 2007). Hence, it may be the case that alternate length intervals *and*

additional methods for assessing life stress may be required to detect the stress generation effect in undergraduates. For example, Gibb and colleagues (2006) failed to show that inferential style predicted stress generation over a 6-week period, despite demonstrating the basic stress generation effect of dysphoria and diathesis-stress effects in undergraduates.

Together, the current results may also provide evidence that interpretive biases do not directly predict stress generation. Instead, interpretive bias may represent an intermediate step towards depression that is enacted via alternate pathways. For example, interpretive biases may contribute to the development of subsequent memory biases and associated negative self-relevant information processing (Hertel & Brozovich, 2010; Salemink, Hertel, & Mackintosh, 2010; Tran et al., 2011). Alternately, interpretive biases may lead to maladaptive interpersonal behaviours and reactions, which may themselves contribute to stressful life circumstances or directly to dysphoria (Barrett & Holmes, 2001; Barrett, Rapee, Dadds, & Ryan, 1996; Cummings et al., 2010; Sahl et al., 2009). Future studies should investigate these possibilities to gain a more full understanding of the relationships between interpretive bias and stress.

Does Interpretive Bias Interact With Stressful Life Events to Predict Changes in Depressive Symptoms?

As a complement to the stress generation model, this study also examined interpretive bias within the context of a diathesis-stress framework (Beck, 1987). None of the interpretive bias variables interacted with dependent life stress to predict depressive symptoms at follow-up. The lack of significant results is surprising given the history of prior empirical research that has found support for diathesis-stress models of the

relationship between cognition, stress, and depression (e.g., Abela & Hankin, 2011; Abela & Skitch, 2007; Gibb et al., 2006; Hankin et al., 2004, 2008; Lewinsohn et al., 2001; Metalsky & Joiner, 1992; Seeds & Dozois, 2010). These null findings are also contrasted against the promising research on cognitive bias modification of interpretation (CBM-I) techniques and their associated outcomes (for reviews, see Hallion & Ruscio, 2011; Field & Lester, 2010). While there is mounting evidence that modifications in interpretive bias may moderate individuals' reactions to stress (e.g., Holmes et al., 2009; Mackintosh et al., 2006; Wilson et al., 2006), this does not necessarily imply that interpretive bias is itself a diathesis. Perhaps the current investigation uncovered contradictory findings because it focused on a particular form of cognitive bias one that has rarely been investigated in the context of diathesis-stress models (Ingram et al., 2008). Future research should investigate alternate roles of interpretive bias in the context of stress and the trajectory towards depression, and examine potential moderating variables in more integrated models.

Strengths, Limitations, and Future Directions

As with all empirical research, this study is not without its strengths and limitations. In the present study, the 5-week interval between Time 1 and Time 2 was selected to optimize participant retention and responding (e.g., Auerbach et al., 2010; Gibb et al., 2006; Shih, 2006). This time frame was selected based on the knowledge that variability in participants' reporting of life events depends on the time interval being asked about (e.g., participants tend to respond "yes" to fewer events the longer the interval; Klein & Rubovits, 1987). Additionally, the life stressors inquired about in the current study included both major life events and minor hassles to maximize statistical

power (e.g., Alloy et al., 1999). However, the relatively short interval between Time 1 and Time 2 may have prevented the discovery of significant effects due to the length of time that it sometimes takes for stress generation effects to unfold (Abela & Hankin, 2011; Flynn et al., 2010; Kercher & Rapee, 2009; Safford et al., 2007; Shih et al., 2009). At the same time, the opposite may also have been true—that the biases captured by the interpretive bias indices at Time 1 reflected early indicators of an impending depression or a prodromal phase. A longer follow-up interval would provide a more powerful test of these hypotheses.

Given that the current study presented an novel preliminary examination of interpretive bias in the context of life stress and depression, the experiment-wise/family-wise error rate was not modified a priori from $\alpha = .05$. Although it is possible that some of the findings may be due to Type I error, if reliable and valid, these findings offer an innovative examination of multiple indices of interpretive bias in the context of life stress and depression. In part, providing evidence for the problematic situation which cognitively vulnerable individuals face—not only are they more likely to develop depression following stressors, but they may, in part, be contributing to the creation of the very stressors that will trigger, maintain, and/or exacerbate their depression. It will be important for future research to examine the replicability of the current study's findings to ascertain their validity.

The relationship between interpretive bias, life stress, and depression is complex and not necessarily unidirectional (Hankin & Abramson, 2001; Simons et al., 1993). In the current study, the interval of the prospective assessment periods differed, such that depressive symptoms were rated over the past 2 weeks and negative life events over a 5-

week period. While this methodology is consistent with the different measurement intervals used in previous studies (e.g., Cole et al., 2008; Gibb & Alloy, 2006; Hankin et al., 2004 study 2; Holahan & Moos, 1991; Kwon & Oei, 1992), this timing does not allow one to precisely determine the temporal sequence of interpretive bias, stressors, and changes in depressive symptoms. Other research using multiple waves of data collection has demonstrated that stressors do, indeed, precede and predict prospective changes in internalizing symptomatology (e.g., Hankin, 2008a, 2008b; Hankin et al., 2008; Hawley, Ho, Zuroff, & Blatt, 2007; Lee, Hankin, & Mermelstein, 2010). In the current study, elevations in dysphoria may have preceded interpretive biases and contributed to the occurrence of life stressors. Multiple time points of measurement follow-up or macro-level examination of daily fluctuations in stress, mood, and interpretive biases would allow for a more thorough exploration of the direction and nature of these pathways to elucidate temporal precedence and causal directionality in the generation of dependent life stressors and onset of depressive mood (e.g., Cummings et al., 2010; Hankin, 2008a, 2010; Hankin et al., 2008; Sahl et al., 2009).

The use of multiple methods for assessing interpretive bias represented a particular strength in the design of the current study; however, there were also limitations inherent with this methodology. The interpretive bias indices themselves may be called into question, as the current study's results were sometimes counterintuitive. Furthermore, the results of the current study did not demonstrate the expected differentiation between the no-load and cognitive load conditions on the SST, suggesting that performance in *both* conditions was associated with concurrent symptoms and predictive of subsequent depressive symptoms. This result, while opposing the theorized

impact of volitional thought control on responses to the SST (Wenzlaff & Bates, 1998), is consistent with previous work that has used similar undergraduate student samples (Rude et al., 2002). It may be the case that differences in the predictive significance of the cognitive load condition only emerge with clinically significant depressive episodes, and not merely subthreshold depressive symptom changes (Rude et al., 2003, 2010). Compared to previous undergraduate samples, the current study's participants had significantly higher negativity ratios across conditions, suggesting that they may have been particular adept at unscrambling sentences. Given that the participants were drawn from a university student population, higher average levels of intelligence could have impacted the effectiveness of the cognitive load (Fink & Neubauer, 2001). Additionally, the cognitive load used in the current study may have been insufficient in size to interfere with participants' cognitive-processing capacity (Engle, 2002). Future studies should examine the effect of more complex cognitive loads on results on the SST and should investigate whether participants' cognitive ability (i.e., intelligence) moderates the effectiveness of cognitive load manipulations.

There may also be concerns about the ecological validity of laboratory-based measures of interpretive bias. Individuals make interpretations of ambiguous information in the social world. Laboratory measures, such as unscrambling sentences or being asked the put yourself in the place of the narrator of stories, unfortunately cannot necessarily reflect the full scope of contextual factors that contribute to an interpretation. Furthermore, even though experimental stimuli were presumed to be self-referent or were worded in second-person narrative ("you are..."), participants likely varied in the extent to which they typically found themselves in the described situations and contexts. As a

result, the findings of the current investigation may not generalize to the types of interpretations that young women make in real life situations. Other studies have struggled with concerns about the ecological validity of assessing interpretive biases in anxiety disorders and have refined their methodologies to increase generalizability (e.g., Amir, Beard, & Bower, 2005; Voncken, Bögels, & de Vries, 2003; Wilson et al., 2006). Future studies on interpretive bias should investigate the comparability of written stimuli to other forms of socially-relevant stimuli (e.g., faces, pictures), stimulus presentation methods (e.g., video, audio), and real life events and situations to determine how alternate forms of interpretive bias assessment can predict stress generation and depression (Peckham et al., 2010).

According to Beck's cognitive theory, cognitive vulnerability factors are latent until activated, and are therefore undetectable in current asymptomatic individuals (Beck et al., 1979; D. A. Clark et al., 1999). Hence, negative mood induction procedures have been used prior to the assessment of interpretive bias in some previous studies (Bisson & Sears, 2007; Dearing & Gotlib, 2009; Lawson & MacLeod, 1999). In real-world settings, however, interpretive bias could be activated by the mere presence of ambiguity. In a sense, the presence of ambiguity *itself* may act as a mood prime. There is some empirical work to support this notion. For example, ambiguity in social situations generally leads individuals to engage in information seeking or tension reducing activities (Ball-Rokeach, 1973). Furthermore, ambiguity or uncertainty appears to intensify affective reactions to events (Bar-Anan, Wilson, & Gilbert, 2009; A. R. Cohen, Stotland, & Wolfe, 1955). Furthermore, intolerance of ambiguity interacts with negative life events to predict depressive symptoms over time (Andersen & Schwartz, 1992). Neurological

investigations have also uncovered enhanced prefrontal activation in brain areas known to be associated with task-induced ambiguity in individuals with depression compared to healthy controls (Diener, Kuehner, Brusniak, Struve, & Flor, 2009). Overall, these results suggest that ambiguity itself is distressing and stressful for individuals, and may thereby potentially be sufficient to activate any latent diathesis, such as interpretive bias. However, empirical research has yet to investigate whether mood induction is necessary prior to the assessment of interpretive bias. Future research should disentangle the activating effects of ambiguity on interpretive bias, and its potential moderation by other relevant trait-like factors such as intolerance of uncertainty (Buhr & Dugas, 2002; Deschenes, Dugas, Radomsky, & Buhr, 2010; Miranda, Fontes, & Marroquin, 2008), intolerance of ambiguity (Frenkel-Brunswik, 1949; Furnham & Ribchester, 1995; Grenier, Barrette, & Ladouceur, 2005), or indecisiveness (Rassin & Muris, 2005). In doing so, studies may determine the necessity of activating stimuli and importance of moderating variables, which may help to explain the equivocal nature of interpretive bias in depression research.

The current study relied on a self-report measure of depressive symptoms (i.e., BDI-II) in a sample of undergraduates. As such, the effects observed here may not necessarily generalize to the prediction of diagnosable episodes of depression. Moreover, adolescents and young adults who attend university may differ in important ways from those who do not, and may consequently show differences in their information processing tendencies, exposure to stressful life events, and dysphoria (e.g., Coyne, 1994; J. Ruscio, Brown, & Ruscio, 2009; J. Ruscio, Zimmerman, McGlinchey, Chelminski, & Young, 2007; Solomon, Ruscio, Seeley, & Lewinsohn, 2006). Notwithstanding this criticism,

samples such as the current one are appropriate to study in their own right, given the reasonable continuity of depression between student and clinical samples and the incidence of depression for individuals in this age range (e.g., Flett, Vredenburg, & Krames, 1997; Hankin, Fraley, Lahey, & Waldman, 2005; A. M. Ruscio & Ruscio, 2002). It is also prudent to examine such samples, given the broader research that supports depression as a continuous, rather than discrete, construct across the lifespan (Ayuso-Mateos, Nuevo, Verdes, Naidoo, & Chatterji, 2010; Franklin, Strong, & Greene, 2002; Holland, Schutte, Brennan, & Moos, 2010; Klein, 2008; Prisciandaro & Roberts, 2005, 2009; J. Ruscio & Ruscio, 2000; Slade, 2007; Slade & Andrews, 2005; for recent review, see Haslam, Holland, & Kuppens, 2012). In addition, the conceptual questions raised in this study pertain to the prediction of future depressive symptoms vis-à-vis cognition via stress generation or cognition by stress interactions. The extent to which these findings generalize to clinical samples (although interesting) does not detract from the importance of understanding stress generation and diathesis-stress models themselves (cf. Haaga & Solomon, 1993). We know, for instance, that subthreshold depression results in significant disruption in functioning (Boulenger, Fournier, Rosales, & Lavallée, 1997; Judd, Paulus, Wells, & Rapaport, 1996; Rai, Skapinakis, Wiles, Lewis, & Araya, 2010; Rivas-Vazquez, Saffa-Biller, Ruiz, Blais, & Rivas-Vazquez, 2004), and predicts future diagnosable depression (Fergusson, Horwood, Ridder, & Beautrais, 2005; Gotlib, Lewinsohn, & Seeley, 1995; Iacoviello, Alloy, Abramson, & Choi, 2010; Judd et al., 2000) and, as such, is an important entity to test using diathesis-stress models. Future studies in this area should incorporate semi-structured diagnostic interviews, such as the Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID; First, Spitzer,

Gibbon, & Williams, 2005) or clinician-rating scales of symptoms, including the Hamilton Rating Scale of Depression (HAM-D; Hamilton, 1960), when conceptualizing depression in this context. This would allow for greater certainty about the causal sequence from cognitive biases to diagnosable episodes of depression.

For decades, there has debate around the theoretical and methodological issues related to the assessment of life stress (Depue & Monroe, 1986; Monroe & McQuaid, 1994; Monroe & Roberts, 1990; Paykel, 1983; Tausig, 1982). Reliance on self-report measures of stress is a common methodological limitation of stress generation and diathesis-stress studies (Liu & Alloy, 2010). In addition to a general concern that depressive mood state biases affect the retrospective recall of life events, is the issue regarding the reliability of self-report checklists to quantifying stressors objectively (for reviews, see Dohrenwend, 2006; Mazure, 1998; Monroe, 2008). Compared to interview-based assessments, self-report measures of stress are more susceptible to participants' biases in over-reporting of life events, and do not allow researchers to differentiate between actual versus perceived events (Brown & Harris, 1978; Monroe & Simons, 1991; Simons, 1992). For example, some studies have shown that individuals with depression and those with vulnerabilities to depression have a tendency to perceive or report benign events as stressful (e.g., Joiner, Wingate, Gencoz, & Gencoz, 2005). In a sense, depression and cognitive vulnerability to depression generate the *perception* that life has become more stressful, whereas in actuality it may not. However, many studies have found no mood-state association between depressed mood and increased reporting or severity ratings on life event checklists (e.g., Lakey & Heller, 1985; Siegel, Johnson, & Sarason, 1979; Wagner, Abela, & Brozina, 2006), although some have (e.g., L. H.

Cohen, Towbes, & Flocco, 1988; Shrout et al., 1989). At the same time, self-report measures allow for a greater ease in collecting data, with less intensive time involvement and burden for participants. Some recent research even suggests that self-reported checklists of stressors and interviewer-based measures of negative life events may be comparable for the purposes of research studies (e.g., Lewinsohn, Rohde, & Gau, 2003; Wagner et al., 2006). In the current investigation, baseline depressive symptoms and worst lifetime depression history were controlled for in all the aforementioned analyses to address the concern of mood state biases. Furthermore, analyses were conducted to compare the frequency of life events in the current study against other studies using similar follow-up periods. The rates of life event endorsement in the present study were consistent with previous empirical work (e.g., Gibb et al., 2006; Hankin et al., 2010; Uhrlass & Gibb, 2007). Future studies should obtain informant data on participants life events to corroborate the occurrence and impact of actual life stressors (Joiner et al., 2005; Lakey & Heller, 1985), and should gather measures of perceived levels of stress in addition to stressor frequency data to compare the unique role of each (Linn, 1986; Masuda & Holmes, 1978) . Alternately, research could incorporate semi-structured contextual life stress interviews, such as the LEDS (Brown & Harris, 1978), to assess for *objective* stressors in different thematic domains (e.g., achievement and interpersonal) and of differing severities and durations (e.g., severe vs. mild; chronic vs. acute).

A second concern is that self-report measures of life stress do not allow for gold-standard assessment of the dependence or independence of events because they fail to provide the rich contextual information essential to differentiate precisely between dependent and independent life events. For example, “getting laid off from a job” can

result both from poor performance by the employee—an example of a clearly dependent event—or from downsizing of the company in general—an example of a clearly independent event. To try to compensate for this limitation, the comprehensive list of life events in the current study was scored for independence and dependence by Ph.D.-level raters with experience in contextual life event rating systems, and any events that did not fit clearly into a category were excluded from all analyses. Contextual stress interviews, such as the LEDS, or newer hybrid systems combining self-report formats with follow-up probes (Slavich, personal communication) may also help to ascertain and categorize events more precisely. A more fine-grained analysis of the severity or perceived impact of particular stressors may elucidate the instances or mechanisms through which diathesis-stress interactions lead to depression (Hammen, 2005; Monroe & Simons, 1991).

Because this sample consisted only of women, it is difficult to determine whether the results of the current investigation would generalize to men as well. There is some evidence that cognitive vulnerabilities display gender-specific associations with stress generation and depression, especially for women (e.g., Safford et al., 2007; Shih, 2006; Shih & Eberhart, 2010). Future studies would need to examine gender as a moderator to determine if men display the same associations between interpretive bias, stress, and depression. At the same time, other moderators should be considered. For example, not all individuals who experience a stressful life event go on to develop depression. Therefore, it would not be expected that everyone with a negative interpretive bias would develop depression to the same degree in response to similar stressors. Hence, protective factors (e.g., social support, coping strategies; S. Cohen & Wills, 1985; Coyne &

Downey, 1991; Paykel, 1994) or other risk factors (e.g., maladaptive personality traits, increased sensitivity to stress; Flett, Blankstein, & Hewitt, 2009; Kendler, Kuhn, & Prescott, 2004; Kercher et al., 2009; Monroe & Harkness, 2005) may need to be considered in an integrated model of interpretive bias in the context of life stress and depression.

Conclusion

This study advances the literature, first by extending the knowledge base on the influence of cognitive vulnerability to depression and information processing factors that may more directly lead to stress generation and depression. Importantly, the influence of interpretive bias on stress generation has never been investigated previously, and its exploration offers a more fulsome understanding of the manner in which cognitive factors potentially have their influence on the generation of life stress. Furthermore, by incorporating multiple forms of assessment of interpretive bias using self-referential stimuli, this study improves upon previous studies which have relied on primarily self-report measures that are influenced by participant mood state and accompanying response biases (Beevers, 2005; Rude et al., 2010) or have utilized non-self-referential stimuli (Bisson & Sears, 2007; Lawson & MacLeod, 1999; Mogg et al., 2006). By examining interpretive bias in the context of life stress and depression we may better understand how pre-existing cognitive vulnerabilities may be enacted through thoughts and actions in real life situations.

From a practical standpoint, understanding what thoughts individuals might exhibit in ambiguous situations may provide a target for intervention by helping clients to see how their thoughts and behaviour to situations may be biased or more negative than

they should be, given the amount of information they are presented with. Clinically, working with clients to generate alternative explanations, and teaching them to determine an appropriate reaction to the most likely explanation based on evidence, may help to alleviate some of the stress generation in their lives. In fact, recent research on children with clinical anxiety disorder diagnoses has shown that successful treatment with cognitive behavioural therapy was also associated with significant decreases in negative interpretation biases (Creswell, Schniering, & Rapee, 2005; Waters, Wharton, Zimmer-Gembeck, & Craske, 2008). Beyond conventional clinical work, CBM-I techniques also pose a promising experimental therapeutic intervention that may also help to prevent the generation of life stress, the negative consequences of stress, and the development of depression. For example, in cases where participants were trained to interpret ambiguity in a nonthreatening or positive way, there is evidence of attenuated emotional reactions following subsequent video stressors or imagined social situations (Lester et al., 2011; Mackintosh et al., 2006; Wilson et al., 2006). Furthermore, repeated sessions of CBM-I have also shown promise at helping to improve mood, interpretive bias, and mental health in persons with current clinical depression (Blackwell & Holmes, 2010).

Beyond its role in stress generation, interpretive bias has never been incorporated into diathesis-stress models of depression. Integrating interpretive bias into these well-established cognitive models provides a preliminary step toward understanding how information processing biases may lead to depression (Ingram et al., 2008). Such integration may also provide a starting point for helping to move research beyond merely characterizing the forms of interpretive bias possessed by individuals with current depression/dysphoria or depression histories. Other idiosyncratic factors, such as the

occurrence of stressors, may help to explain the equivocal nature of interpretive bias in the depression literature. As many researchers have pointed out, simplistic models that fail to account for the environment may not be sufficient to describe the complexities of human experience or psychopathology (Bronfenbrenner, 1979; Hammen, 1992; Rutter & Sroufe, 2000; Sameroff, 2000; Zahn-Waxler, Klimes-Dougan, & Slattery, 2000). It is only by understanding the risk factors for depression that we can ever hope to prevent and intervene with one of the most economically, socially, and interpersonally costly of all disorders (Richards, 2011).

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Appendix A

Statistical Comparisons Between Dropouts and Completers of Time 2

A total of 9 participants (4% of the original sample) participated at Time 1 but did not complete any portion of the Time 2 assessment. This attrition rate is somewhat lower than the typical attrition rates observed in other prospective studies using similar follow-up intervals (e.g., 8-11% across Studies 1 to 3, Joiner et al., 2005; 11%, Metalsky & Joiner, 1992). Participants who opted not to complete the Time 2 assessment had a significantly higher average level of depressive symptomatology at Time 1 (M = 19.11, SD = 10.54) than did those who completed the Time 2 assessment (M = 12.85, SD = 8.80), $t(214) = -2.07$, $p = 0.04$. Not surprisingly, participants who failed to complete the Time 2 assessment were also more likely to have reported a history of a mental disorder diagnosis, $\chi^2(1) = 22.33$, $p < 0.001$, Phi = -0.32, and history of therapy or counselling treatment for an emotional or psychological problem, $\chi^2(1) = 7.17$, $p = 0.01$, Phi = -0.18, than those who completed both Time 1 and Time 2. The students who did not complete the follow-up assessment did not differ from the final sample on any of the other demographic characteristics, cognitive tasks, or symptoms measures at Time 1. Because of the very small attrition rate and the minor differences, it is unlikely that the results of this study were significantly influenced by the 9 dropouts.

Appendix B

Statistical Comparisons Based on Participant Recruitment Source

A total of 11 participants (5% of the Time 1 and Time 2 samples) were recruited using posters on the university campus requiring that they be registered in a first-year class at the University of Western Ontario, as compared to the majority of the sample which was recruited through the Psychology Research Participant Pool for students enrolled in the Psychology 1000/1200 course (95% of the Time 1 and Time 2 samples). Participants who were recruited from posters on campus had significantly lower average depression symptom history levels (M = 3.91, SD = 8.72), as assessed by the IDD-L, compared to participants who were recruited through the Psychology Research Participant Pool (M = 14.60, SD = 16.98), $t(14.45) = 3.71$, $p = 0.002$. Additionally, participants who were recruited from posters were more likely to be of non-Caucasian ethnic descent (e.g., Asian, Black/African Canadian, etc.) than students recruited through the PSYC 1000/1200, $\chi^2(5) = 14.99$, $p < 0.05$, Phi = 0.26. The students who were recruited using posters on campus did not differ from the participants recruited through the Psychology Research Participant Pool on any of the other demographic characteristics or study measures at Time 1 or Time 2. Because of the very small sample size and the minor differences, it is unlikely that the results of the current study were significantly influenced by the 11 general campus recruits.

Appendix C

Demographic Questionnaire

Participant #: _____ Date of Testing: _____

Date of Birth: _____ Age: _____
Day/Month/Year

Gender: □ Male □ Female

Ethnicity: □ Black/African Canadian □ Asian □ Hispanic or Latino
□ Aboriginal/Native Canadian □ East Indian □ White/Caucasian
□ Native Hawaiian or other Pacific Islander
□ Other please specify: _____

Marital Status: □ Single □ Married/Common-law/Engaged
□ Divorced/Separated □ Widowed

Have you ever been diagnosed with a mental disorder? □ Yes □ No

If so, which one(s)? -
_____

Have you ever received any therapy or counselling for an emotional or psychological problem? □ Yes □ No

Please describe what type of therapy or counselling you received:
_____

Have you ever received any medication for an emotional or psychological problem? □ Yes □ No

Please describe what type of medication you received:
_____

Appendix D

Scrambled Sentences Test Stimuli

water is sometimes very hot cold
cat the has fur black yellow
arrived she home after six before
movie the somewhat funny tragic was
interesting life my boring generally is
usually like people not me do
equal am others I inferior to
worthwhile I worthless am a person
failure I a am generally success
love I others' don't deserve generally
about do care people me don't
have I my friends lost helped
is appearance physical my unchanged worsening
well me people of poorly think
am I ruining life improving my
person an am inadequate I adequate
others' cannot I can meet expectations
I little offer to have much
my wasted I utilized have opportunities
have life succeeded failed I at
happy miserable be I expect to
curious I person bad a am
will goals I cannot achieve my
me to is life cruel good
disappointed have I friends pleased my
trying keep to stop want I
good feel very bad I usually
myself in disappointed am confident I
life makes good nothing me feel
I fail will once succeed more
something I give nothing to have
usually feel I energetic tired very
who I dislike I am like
good mostly memories my sad are
is stressful life interesting my very
personal satisfying my disappointing relationships are
things can't I get can together
born I loser a winner am
quite generally incapable I capable am
person good a am defective I
my boring is interesting life usually
often crying like I laughing feel

seldom death often of think I
decisions problems making I confidence have
is my good health physical poor
concentration worse now my is better
ruining I life improving am my
think I future worry the about
acceptable physical appearance worsening my is
most happy me unhappy things make

Appendix E

Ambiguous Stories Task Stimuli

Item #	Sentence 1	Sentence 2	Sentence 3	Negative Target	Positive Target	Foil	Comprehension Check	Comp Answer (Y=1, N=0)
1	As you are walking into the cafeteria, you see your friend sitting on the other side.	You call out her name, but she does not answer you.	You think that she doesn't answer because she is _____ .	Annoyed	Busy	Successful	Was your friend sitting on the other side of the cafeteria?	1
2	When you walk into the arena for a hockey game, you see your friends sitting toward the front.	You call to them from the door, but no one looks at you.	You think no one responds because they are _____.	Annoyed	Occupied	Smile	Were your friends sitting in the back of the arena?	0
3	One day, you walk into the crowded cafeteria looking for a place to sit.	Your friends are all sitting together but there are no seats next to them for you to sit in.	The fact that they don't have a seat saved for you is _____.	Rude	Fine	Misery	Was the cafeteria crowded?	1
4	You have plans	She says she	Her reason for	Fake	Believable	Excited	Did she call	0

	to go to a movie with a friend of yours, and you are at home getting ready to meet her when she calls you.	can't make it after all because she needs to study.	cancelling seems _____.				you the day before to cancel?	
5	Recently, you had a fight with a friend of yours, and you decide to invite her over to watch a movie as a way of making up.	At first, she says she'll come, but then later she calls to say she can't make it.	You think she cancelled because she is _____.	Angry	Busy	Guilt	Did you invite your friend over to play a game?	0
6	In your first lecture, your professor informs the class that you will be doing group projects.	Your professor picks group leaders, and tells them to take turns picking group members.	You are certain that you will be picked _____.	Last	First	Funny	Did your classmates elect the group leaders?	0
7	One day, you notice your best friend sharing notes with a stranger in class.	They smile at each other and giggle, and then your friend looks at you.	You think your friend wants you to feel _____.	Jealous	Included	Loser	Did your friend and the stranger smile at each other?	1

8	One day, you are walking down the hall, when you see your best friend talking to a girl you really dislike.	As you walk toward them, you hear them talking and laughing, and then your friend looks at you.	Because of the way she looks at you, you think she is trying to make you feel _____.	Excluded	Welcomed	Caring	Was your friend talking to someone you like?	0
9	You are giving a presentation in your a class and during your presentation, you hear a few students whispering to each other.	When you are through, you take your seat in class.	The student next to you passes you a note that says, "Your report was really _____."	Boring	Great	Ashamed	Did you sit down after you finished your presentation?	1
10	You are in class and your instructor is handing back tests.	When you look at your test grade, you are surprised because it is not the grade you had expected.	Your instructor leans over and tells you that this is because, on this test, your work was _____.	Dreadful	Terrific	Pleasure	Did you look at your test after the instructor handed it to you?	1
11	In psychology class, you are given an extra credit	You read the assignment carefully but can't figure	As you ask for help, you're sure your professor will think you are	Dumb	Hardworking	Death	Did you read the assignment before you asked for help?	1

	assignment.	out how to start it, so you decide to ask your professor for help.	_____.					
12	In psychology class, you are feeling tired when, suddenly, your instructor asks a question and calls on you to give the answer.	As everyone looks at you waiting for you to answer, you think hard and fast.	After stating your answer, you are sure that everyone in the class thinks you sounded _____.	Stupid	Smart	Loved	Were you in psychology class?	0
13	Your TA gives an assignment in class to be completed by the end of the tutorial, and you are the first student to finish it and turn it in.	You worked very hard on it, but after you turn it in, you realize you made one small mistake.	As you think about this, you are sure that your TA will think you are _____.	Careless	Hardworking	Ugly	Did other students turn in their assignments before you?	0
14	You are required to give a presentation in class.	The morning of your presentation, you practice in front of the mirror before	You think that your professor will judge your work as _____.	Sloppy	Terrific	Happy	Did you practice your presentation before class?	1

		you head to class.						
15	You are supposed to write a 1000 word essay for a class, and you start to work on it a week before it is due.	At first, you have a hard time coming up with a topic, but then work hard and finish it in time.	As you think about how you will do, you feel that the grade you will get will be _____.	Bad	Good	Talent	Did you wait until the night before it was due to start your essay?	0
16	You just got a new haircut, and your hair is shorter than it used to be.	When you see your friends for the first time, you notice them looking at your hair.	You can tell by their faces that they think your hair looks _____.	Horrible	Stylish	Bored	Did you change the color of your hair?	0
17	You arrive in class one morning in a new outfit.	Everyone turns around to look at you as you walk in.	Because of their stares, you decide that they must think you look _____.	Awful	Great	Talent	Did everyone ignore you when you entered the classroom?	0
18	A neighbourhood friend of yours invites you to a party.	You've never met any of her other friends before.	As you take one last look at yourself in the mirror, you're sure that her friends will think you look _____.	Ugly	Pretty	Smelly	Were you expecting to see someone you know at the party?	0
19	You and a neighbour of	You try on a dress at one	She looks at the dress on you and says,	Bad	Cute	Glad	Did you show the dress to	1

	yours decide to go to the mall to shop for clothes.	store and come out of the dressing room to show it to her.	"That dress looks really _____."				your neighbour?	
20	It's the first day of the new school year.	Over the summer, your hair grew a lot and think you look really different.	You are sure that your classmates will think that, compared to last year, you look _____.	Worse	Better	Hated	Did you hair grow over the summer?	1
21	You arrive at school one day wearing a new outfit that you got for your birthday.	As you walk into class, two guys sitting in the back of the room look at you and whisper something to each other.	One of them waves at you and says, "You look really _____."	Awful	Cute	Kind	Did you get the new outfit for Christmas?	0
22	It is Halloween and your residence is having a huge costume party.	You spend all week working on your costume, and when you arrive at the party, all the people turn to look at you.	Because of their stares, you decide that they must think your costume is _____.	Ridiculous	Creative	Helpless	Was the Halloween party for your residence?	1
23	You were recently a	Since you don't usually	As you look at the picture you are taking	Ridiculous	Beautiful	Successful	Was the wedding for	0

	bridesmaid in your cousin's wedding and the dress you wore was very fancy.	dress up, your friend wants to see pictures of you in the dress.	to show her, you are certain she'll think you look _____.				your sister?	
24	It's your first day of class and you don't know anyone there.	Your instructor asks you to introduce yourself and tell the class something about yourself.	After you speak, you guess the others think you seem _____.	Shy	Nice	Doom	Did you know anyone in the class?	0
25	On your first day of a new class, you realize that you don't know anyone there.	You spot a group of guys talking on one side of the room.	When you say "hi" to them, you can see that they look _____.	Irritated	Friendly	Joyful	Was it your first day in class?	1
26	You arrange to meet a new classmate at the movie theater, and when you arrive at the theater, she's not there.	While you wait, you think about how you sounded when you made plans with her to meet.	You decide that she must think you are _____.	Strange	Kind	Guilty	Were you the first one to arrive for the movie?	1
27	You have been	Tomorrow,	As you think about	Annoying	Friendly	Pleasure	Had you met	0

	writing to your new roommate over the summer.	you are going to meet your roommate for the first time.	meeting her for the first time, you feel that she will think you are _____.				your roommate before?	
28	On your floor there is a new foreign exchange student.	Your resident advisor has asked you to show him around the campus.	After spending almost the entire day with him, you feel that he must think you are _____.	Boring	Funny	Cry	Did your resident advisor ask you to show him around campus?	1
29	Today in class, your teacher assigns a new group project where you have to pretend you are married to another student and having a baby.	You get paired with the cutest guy in class.	You are sure that, after working on the assignment together, he will think you are _____.	Weird	Cool	Colourful	Does the project require you to work with another student?	1
30	Your family just moved here from Newfoundland and you talk differently than the students.	One day, your neighbour invites you to go to a hockey game with her and some of her friends.	While getting ready, you think about how the night will go, and you decide that your neighbour's friends will think the way you talk is _____.	Strange	Cool	Crying	Did you move here from Newfoundland?	1
31	For your class,	As you	You decide that	Nervous	Confident	Sorrow	Did you have to	1

	you have to give an oral presentation in front of your class of 400 students.	practice, you think about what all the other students will think when you do your presentation.	everyone will think you seem _____.				give your presentation in front of the whole class?	
32	You are taking a writing class, and your teacher wants everyone in the class to read their work out loud.	After you read your essay to the class, one of the other students whispers something to you.	She says that she thought your essay was _____.	Boring	Funny	Pretty	Were you the only one who had to read your work to the class?	0
33	Last week you took your midterm in psychology class.	When you walk into class today, you see that the exam grades are posted at the front of the classroom and everyone is looking at them.	You know other students will look at your grade, and you are sure they will think you did _____.	Well	Badly	Tired	Was the exam you took in psychology?	1
34	During class you learn that	Your friends look over	Because of this, you are sure your friends	Nerdy	Brainy	Athletic	Did you receive the lowest mark	0

	you received the highest grade on the midterm.	your shoulder and see your test mark.	will think you are _____.				in the class?	
35	Your best friend is having a pool party for her birthday and has invited lots of people from school.	Before you go to the party, you try on your swimsuit and look at yourself in the mirror.	You think the other people will think you look _____.	Fat	Skinny	Sloppy	Was your friend having a roller skating party?	0
36	As an assignment, you have to give a short speech to the whole class.	After you give your speech, you are packing up your backpack when a guy from class comes up to you.	He tells you that, when you gave your speech, you seemed really _____.	Nervous	Confident	Skinny	Did you give a speech?	1
37	Your instructor just gave you a surprise quiz.	Now she wants everyone to trade quizzes with the person sitting next to them for grading.	As you give your quiz to another student, you are sure you got most of the questions _____.	Wrong	Right	Fat	Was the quiz a surprise?	1
38	You are asked	Your team	They all say you	Terribly	Brilliantly	Deadly	Did your team	1

	to join a game of beach volleyball with your floor.	loses and afterwards, your teammates talk about how everyone played.	played _____.				lose the game?	
39	You are asked to play a solo at open mike night at the Spoke.	While rehearsing, you make two or three mistakes.	Afterwards, your roommate tells you your playing was _____.	Shaky	Promising	Caring	Did you perform perfectly while rehearsing?	0
40	Your professor asks you to organize a sign-up system for mentoring high school students.	After you put it on the Facebook, several of your classmates comment about the way it is organized.	They say that the way your sign-up sheet is organized is very _____.	Confusing	Clear	Deadly	Did your professor ask you to create the sign-up system?	1
41	You are playing softball.	While you are up at bat, you see two of the outfielders talking and looking in your direction.	You think they might be talking about your skill at batting and saying that you are _____.	Terrible	Talented	Clean	Were the students who were talking sitting in the dugout?	0
42	Your swim	This is the	As you get out of the	Badly	Well	Hated	Was this the	1

	team coach asks you to swim a new, much shorter race in the next competition.	first time you have ever raced in a sprint, and you finish fourth.	pool, one of your teammates walks up to you and tells you that you swam _____.				first time you had raced in a sprint?	
43	You join the debating club and are asked to participate in a debating competition with ten other students.	The debating competition is held in front of a large audience, and in the end, you finish fifth.	Later one of your teammates tells you that he thinks your performance was _____.	Terrible	Great	Happy	Did you finish last in the debate?	0
44	In philosophy, your professor assigns a debate about assisted suicide (euthanasia).	You have to debate against the smartest student in the class.	After the debate you are sure the other students will think you are _____.	Stupid	Smart	Angry	Did you debate gun control?	0
45	You are sitting at a table in the library working hard on an assignment.	Suddenly, one of your classmates walks by and knocks the book you are reading on the floor.	You think her actions were _____.	Intentional	Accidental	Protected	Were you sitting in the library when your classmate walked by?	1
46	After standing in line at lunch to get your	You are talking to a friend as you	You think that the person who pushed you was being	Mean	Clumsy	Tired	Were you walking alone when your tray	0

	food, you are entering the cafeteria to find a place to sit.	walk when, suddenly, you get pushed from behind, and your tray of food falls to the floor.	_____.				was knocked to the floor?	
47	You are talking to a classmate and you learn that one of your friends has been talking about your mother.	She's has been telling people about your mother's illness.	When you hear about what she has been saying, you think she is very _____.	Gossipy	Concerned	Bravery	Has one of your classmates been telling people that your mother is ill?	1
48	In the hallway, you hear some other girls talking and one of them mentions your name.	When they see you, one of them smiles at you.	You can't hear what else they say, but you are sure it must be _____.	Nasty	Nice	Scared	Were the girls talking in the hallway?	1
49	You have been working on a project for biology class every day for the past two weeks.	One day, you arrive at your room to find that your project materials have been dropped on the floor, and some of	You think that this must have happened _____.	Deliberately	Accidentally	Cheerful	Did you just start the biology project yesterday?	0

		them have been completely destroyed.						
50	You overhear some classmates discussing who they like and who they don't like.	You can't really hear what they are saying, but you think you hear one of them mention your name.	You are sure you must be one of the people that they _____.	Dislike	Like	Scare	Do you think you hear them mention your name?	1
51	You arrange to meet a friend at the movies one night.	You arrive before she does.	As you are waiting, you look around the theater and notice that the movie you had hoped to see is not _____.		Playing	Sunny	Did your friend arrive before you?	0
52	As you enter the cafeteria one day, you notice your friends sitting at a table across the way.	One of them looks at you and calls your name.	You see her but can't hear her because the cafeteria is very _____.		Noisy	Purple	Were your friends standing in line to get food?	0
53	One day, you hear about try-outs for the Varsity field hockey team.	You played in high school and decide to try out.	After try-outs, you wait to hear the coach's decisions and hope that you get _____.		Picked	Hungry	Did you play field hockey in high school?	1
54	You just	On most days,	But today, no one is		Cold	Busy	Do a lot of	1

	moved to a new school and don't know anyone there.	you see a lot of students walking around, and you think about trying to meet some of them.	outside, and you guess this is because it is winter and the weather is very _____.				students live in the neighbourhood?	
55	You just got your hair cut and you're not sure about how it looks.	When you see your group of friends, one of them comments on your hair.	She then asks you where you went to get it _____.		Cut	Jumped	Did you just get your nails painted?	0
56	Your TA is breaking the tutorial up into groups of three for a project he is assigning.	You hear him call out your best friend's name, and you know the next person he calls will be in your friend's group.	Naturally you hope the next name he calls is _____.		Yours	Funny	Was the group project for psychology class?	0
57	You arrange to meet a friend at her house after school to study for a test.	You are nervous about the test because the grade counts for a lot.	When you arrive, you are surprised because her room, which used to be blue, has been _____.		Painted	Playing	Did your friend's room use to be red?	0
58	You are at a	You both	So the two of you		Music	Popcorn	Was it too loud	0

	classmate's dorm room studying and you both agree that it is far too quiet.	usually like to do work with some noise in the background.	agree to turn on some _____.				while you were studying?	
59	You are at a concert with some friends.	In between musical acts your friend announces that she is hungry.	Since the next act doesn't start for another hour, you all decide to go find something to _____.		Eat	Party	Were you at a swim meet?	0
60	You are reading quietly in class when one of your classmates bumps into your desk.	You look up to see what happened and lose your place in the book.	Your classmate turns to you and says she is very _____.		Sorry	Bored	Did you lose your place in your book?	1
61	Another student in your residence is having a costume party for her birthday and you are invited.	You decide to dress up as a clown.	When you arrive, several other people comment on your coloured hair and big red _____.		Nose	Table	Did you decide to dress up as a pirate?	0
62	You are playing soccer one day, and you try your	Suddenly, one of your teammates kicks the ball	You turn and kick the ball into the _____.		Goal	Room	Had you played soccer a lot before?	0

	best even though you've never really played before.	to you as you stand near the other team's goal.						
63	In the hallway, you hear a group of girls talking about the guys that they think are cute.	One of them notices you listening and says "hi."	You decide to walk up to the group and join the _____.		Discussion	Picture	Did one of the girls notice you listening?	1
64	You have planned to meet a friend at the mall.	When you arrive, she's not there yet, so you call her cell phone to find out where she is.	She explains that her ride was late picking her up because they got stuck in _____.		Traffic	Garden	Did you call your friend to find out where she was?	1
65	One day you are a little late getting to psychology class.	When you get there, you look for a seat near your friends but there aren't any.	The professor has already started class, so you decide to enter quietly and just take a seat in the back of the _____.		Classroom	Stadium	Were some of your friends in your psychology class?	1

Appendix F

Stressful Life Experiences Questionnaire (SLEQ)

Independence/Dependence Coding

Item Number	Item Wording	Coding
1	You did poorly on, or failed, a test, exam, or major class project in an important course (i.e., grade less than or equal to C).	Dependent
2	Received a negative reaction from family or friends about not doing well in school (e.g., got silent treatment, criticized, etc.)	Dependent
3	Doing worse academically than usually did in previous semesters or than did in high school (difference of at least one grade; e.g., C rather than B).	Dependent
4	Negative consequences from studying for long periods of time (e.g., exhaustion, ill health, loss of friends, etc.)	Dependent
5	You did not have time to do well in school (e.g., because you worked too many hours at a job).	Dependent
6	Dislike school in general, but have to stay (e.g., forced by parents to stay, have no skills to get a job, etc.).	Neither/Unsure
7	Not doing as well in school as you would like.	Neither/Unsure
8	Difficulties with your study or work load.	Independent
9	Difficulty mastering academic material.	Dependent
10	Negative personal encounter with a professor.	Dependent
11	Not accepted (or not expected to be) into program/major of your choice.	Dependent
12	Unable to complete an assignment for school (not due to medical or excusable reason, etc., funeral, etc.)	Dependent
13	Tried to accomplish something (e.g., homework) but had too many interruptions.	Independent
14	Received feedback or evaluation that I needed to work harder/perform better in my classes or job.	Dependent

Item Number	**Item Wording**	**Coding**
15	Prolonged absence from school (not due to medical or other excusable reason, e.g., funeral, etc.)	Neither/Unsure
16	Tried to accomplish something (e.g., homework) but wasted too much time on other activities.	Dependent
17	You didn't complete the required homework for class.	Dependent
18	You didn't get to take a class you wanted to take.	Neither/Unsure
19	You didn't get accepted for an extracurricular activity you wanted to be part of.	Dependent
20	Quit a job.	Dependent
21	Laid off or fired from job.	Neither/Unsure
22	Unable to find work and need a job very much for financial or other reasons.	Neither/Unsure
23	Reprimanded or were yelled at at work.	Dependent
24	Significant negative change in financial circumstances (e.g., large amount of money or valuables lost or stolen, significant decrease in financial support, etc.).	Independent
25	Did not have enough money for one or more necessities and had to do without them. Or, when living with family, family did not have enough money for one or more necessities (necessities are: health care, food, housing, or necessary clothing).	Independent
26	Have not been achieving or accomplishing as much as would like.	Dependent
27	Difficulty with the nature of your work.	Neither/Unsure
28	Difficulty meeting deadlines or goals on the job.	Dependent
29	Problems at work with co-workers or employer.	Dependent
30	Major change in work or school hours.	Independent
31	Organization you belong to (e.g., club, team) failed to accomplish an important goal.	Neither/Unsure
32	Parents upset with me for not living up to their standards/expectations (e.g., not doing well in school, sports, etc.).	Dependent

Item Number	**Item Wording**	**Coding**
33	Significant fight or argument with close family member that led to serious consequences such as self or family member crying, temporary loss of privileges, emotional distance, etc.	Dependent
34	Close family member became so upset with you that she/he ended the relationship.	Dependent
35	Trying but can't seem to please your mother and/or father.	Dependent
36	Can't tell how family member really feels about you.	Neither/Unsure
37	Trying but can't seem to get close to one or more family members.	Dependent
38	You did something you didn't want to do in order to please a close family member.	Dependent
39	A close family member (parent, sibling) died.	Independent
40	Found out that close family member has been criticizing you behind your back.	Dependent
41	Fights or disagreements with one or more close family members (parent, sibling).	Dependent
42	Put down by your parents or parents showed dislike.	Dependent
43	It seemed like your parents were disappointed with you.	Dependent
44	A close family member (parent, sibling) had significant medical or emotional problems (e.g., heart disease, cancer, depression, etc.)	Independent
45	Family member has life threatening illness.	Independent
46	Conflicts with your parents over your personal goals, desires, or choice of friends.	Dependent
47	You didn't receive the love, respect, or interest from your parents that you wanted (e.g., did not receive compliments or praise from parents, parents did not call or write, parents did not listen or show interest, etc.).	Dependent
48	Forced by parents to achieve things that you could not or did not want to achieve (e.g., have to be a star athlete even though would rather concentrate on other interests, punished if do not excel in everything undertaken, etc.)	Dependent

Item Number	Item Wording	Coding
49	A close family member (parent, sibling) withdrew love or affection from you.	Dependent
50	A close family member (parent, sibling) was arrested.	Independent
51	A close family member (parent, sibling) was hospitalized for serious injury or illness.	Independent
52	Relationship with close relative (parents, siblings, etc.) became worse.	Dependent
53	Your parents separated or divorced.	Independent
54	You didn't spend as much time with close family members as you wanted to.	Dependent
55	A close family member (parent, sibling) couldn't work due to injury or illness.	Independent
56	A family member let me down (e.g., didn't call, meet me, or do as promised).	Dependent
57	Remarriage of parent.	Independent
58	A close family member (parent, sibling) lost their job.	Independent
59	Family member(s) were too busy to talk, help, or spend time.	Dependent
60	Close family member(s) moved away.	Independent
61	You had to take care of brothers/sisters when you didn't want to.	Independent
62	Trying but can't seem to fully please roommate.	Dependent
63	Criticized by one or more roommates.	Dependent
64	Can't tell how one or more roommates really feel about you.	Neither/Unsure
65	Trying but can't seem to get close to one or more roommates.	Dependent
66	Did something you did not want to in order to please roommate.	Dependent
67	Found out that roommate has been criticizing you behind your back.	Dependent
68	Fight or disagreement with one or more roommates.	Dependent
69	Roommate has been withdrawing affection from you.	Dependent
70	Friend(s)/roommate(s) were too busy to talk, help, or spend time.	Dependent

Item Number	Item Wording	Coding
71	A close friend had significant medical or emotional problems (e.g., heart disease, cancer, depression, etc.)	Independent
72	Close friend becomes so upset with you that she/he ends relationship.	Dependent
73	Trying but can't seem to fully please friend.	Dependent
74	Criticized by one or more friends.	Dependent
75	Can't tell how one or more friends really feel about you.	Neither/Unsure
76	Trying but can't seem to get close to one or more friends.	Dependent
77	Found out that friend has been criticizing you behind your back.	Dependent
78	Death of pet.	Independent
79	A close friend died.	Independent
80	Have hardly any friends.	Dependent
81	Not sought out by others for activities or friendships (e.g., not called by others and asked to do something fun, etc.)	Dependent
82	Close friend has been withdrawing affection from you.	Dependent
83	Did not receive an expected visit from (or couldn't visit) family or friends (e.g., from outside city).	Neither/Unsure
84	Decrease in amount of leisure time.	Neither/Unsure
85	You didn’t talk or share feelings with friends.	Dependent
86	You aren’t friends with the people you want to be friends with.	Dependent
87	Did something awkward or embarrassing in a social situation.	Dependent
88	Chose to terminate relationship with close friend.	Dependent
89	You didn’t have time to spend with your friends when you wanted to be with them.	Dependent
90	A friend let me down (e.g., didn’t call, meet me, or do as promised).	Dependent
91	You had a fight or argument with a close friend.	Dependent

Item Number	**Item Wording**	**Coding**
92	Your friends pressured you to do things you didn't want to.	Dependent
93	A close friend did not treat you as well as he/she used to.	Dependent
94	A close friend moved away.	Independent
95	Found out friend(s) had a negative belief about you.	Dependent
96	Found out friend(s) spread negative gossip about you.	Dependent
97	A close friend was hospitalized for serious injury or illness.	Independent
98	A close friend was arrested.	Independent
99	Decreased number of friends.	Dependent
100	Learning that a close friend or relative is very different than you thought (e.g., sexual behaviour, involvement with serious drugs, criminal activities, etc.)	Independent
101	Not accepted into social organization you desired.	Dependent
102	Not invited to an important social event.	Dependent
103	You didn't have anyone to go out with on the weekends when you wanted to go out.	Dependent
104	Your friends didn't seem to understand you.	Dependent
105	Found out I was gossiped about.	Dependent
106	Close friend or relative encountered serious trouble or failure experience.	Independent
107	Tried to share something important with a friend, family member, or romantic partner, and they acted disinterested.	Dependent
108	A friend, family member, or romantic partner embarrassed me or hurt my feelings in front of others.	Dependent
109	Argument/conflict with someone other than a friend, family member, or romantic partner.	Dependent
110	Difficulty with landlord/landlady.	Dependent

Item Number	**Item Wording**	**Coding**
111	Significant fight or argument with boyfriend/girlfriend/spouse that that led to serious consequence(s) such as self or boyfriend/girlfriend/spouse crying, leaving common residence for one night, etc.	Dependent
112	Boyfriend/girlfriend/spouse ends relationship, but you still want to be with them.	Dependent
113	Boyfriend/girlfriend/spouse says he/she is not sure whether wants relationship to continue.	Dependent
114	Trying but can't seem to fully please your girlfriend/boyfriend/spouse.	Dependent
115	Criticized by your boyfriend/girlfriend/spouse.	Dependent
116	Trying but can't seem to get close to boyfriend/girlfriend/spouse.	Dependent
117	Found out that boyfriend/girlfriend/spouse has been criticizing you behind your back.	Dependent
118	You found out that your boyfriend/girlfriend/spouse has been cheating on you.	Dependent
119	You did something to please your girlfriend/boyfriend/spouse that you didn’t want to do.	Dependent
120	While still involved with boyfriend/girlfriend/spouse, she/he had a date with someone else.	Dependent
121	Death of boyfriend/girlfriend/spouse.	Independent
122	Fight or disagreement with boyfriend/girlfriend/spouse.	Dependent
123	Can't tell how boyfriend/girlfriend/spouse really feels about you.	Dependent
125	Did not receive love, respect, or interest from boyfriend/girlfriend/spouse (e.g., did not receive compliments or praise, boyfriend/girlfriend/spouse did not listen or take interest in you, etc.)	Dependent
126	Boyfriend/girlfriend/spouse withdrew affection from you.	Dependent
127	Boyfriend/girlfriend/spouse let me down (e.g., didn’t call, meet me, or do as promised).	Dependent
128	Decreased amount of dating.	Dependent
129	Showed interest in someone and they rejected me.	Dependent

Item Number	Item Wording	Coding
130	You terminated an intimate relationship (boyfriend/girlfriend/partner).	Dependent
131	Infidelity toward boyfriend/girlfriend/spouse (i.e., you cheated on them).	Dependent
132	Breakup of affair.	Dependent
133	Conflicts with your boyfriend's/girlfriend's/spouse's family.	Dependent
134	Loss of virginity which was completely or partially unwanted.	Dependent
135	You had to do chores or work you didn't want to do.	Dependent
136	Physical appearance became worse or much worse.	Neither/Unsure
137	Failed to meet a daily fitness goal.	Dependent
138	Had a minor illness, injury, or some other physical discomfort.	Independent
139	Female: Possibility of an unwanted pregnancy; Male: Possibility of a girlfriend/wife/partner's unwanted pregnancy.	Dependent
140	Female: Had an abortion; Male: girlfriend/wife/partner had an abortion.	Dependent
141	Involvement in serious accident (e.g., automobile, work, home, etc.).	Neither/Unsure
142	Hospitalization of self.	Independent
143	Physical health became worse or much worse (due to illness or accident).	Independent
144	Worsening of personal health/habits.	Dependent
145	Victim or serious threat of natural disaster (e.g., flood, tornado, hurricane, earthquake, drought, avalanche, etc.)	Independent
146	Difficulty taking care of paperwork (e.g., paying bills, filling out forms).	Dependent
147	Poor weather.	Independent
148	Experienced a transportation problem (e.g. , car problems, late bus).	Independent
149	Misplaced or lost something.	Dependent

Item Number	**Item Wording**	**Coding**
150	Someone cancelled an important appointment with little or no advanced notice.	Neither/Unsure
151	Was concerned about an event on the news.	Neither/Unsure
152	Was delayed/late due to circumstances beyond my control.	Independent
153	Committed a minor law violation (e.g. traffic ticket, disturbing the peace, dormitory violation).	Dependent
154	Significant problem with the law (e.g., arrested, detained, etc.)	Dependent
155	Was the victim of a crime (e.g. theft, assault).	Independent
156	Witness an accident or act of violence	Independent
157	Had a financial difficulty (e.g. unexpected expense, overspent, etc).	Neither/Unsure
158	No enough money for extras (e.g., entertainment, recreation, vacations, etc.).	Neither/Unsure
159	Significantly increased you level of debt beyond means of repayment.	Neither/Unsure
160	Has anything happened to you in the past 5 weeks that has not been covered, but that you feel was important?	Neither/Unsure

Appendix G

Institutional Ethics Review Board Ethics Approval Notice

Department of Psychology The University of Western Ontario
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Use of Human Subjects - Ethics Approval Notice

Review Number	**10 08 04**	**Approval Date**	**10 08 20**
Principal Investigator	**David Dozois/Pamela Seeds**	**End Date**	**11 08 30**
Protocol Title	**Life stress and mood**		
Sponsor	**n/a**		

This is to notify you that The University of Western Ontario Department of Psychology Research Ethics Board (PREB) has granted expedited ethics approval to the above named research study on the date noted above.

The PREB is a sub-REB of The University of Western Ontario's Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement and the applicable laws and regulations of Ontario. (See Office of Research Ethics web site: http://www.uwo.ca/research/ethics/)

This approval shall remain valid until end date noted above assuming timely and acceptable responses to the University's periodic requests for surveillance and monitoring information.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the PREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of research assistant, telephone number etc). Subjects must receive a copy of the information/consent documentation.

Investigators must promptly also report to the PREB:
a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to the PREB for approval.

Members of the PREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the PREB.

Clive Seligman Ph.D.

Chair, Psychology Expedited Research Ethics Board (PREB)

The other members of the 2009-2010 PREB are: David Dozois, Bill Fisher, Riley Hinson, and Steve Lupker

CC: UWO Office of Research Ethics

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Appendix H

Data Analytic Strategy and Rationale for Question 2 - Does Interpretive Bias Predict Stress Generation?

Because the present study examined the frequency of dependent and independent life events that participants experienced over the course of a 5-week period, the dependent variables of interest represent count data. Count variables reflect the occurrence of discrete events and thus can only take the form of non-negative integers (e.g., 0, 1, 2, 3…). Count data present a significant challenge to researchers; however, these challenges can be overcome with statistical techniques specifically designed for this sort of data (Atkins & Gallop, 2007; Coxe, West, & Aiken, 2009; Hutchinson & Holtman, 2005). Despite the fact that appropriate techniques are available, many researchers fail to use them (Atkins & Gallop, 2007; Walters, 2007). For example, count data are often treated as continuous variables and analyzed through ordinary least squares (OLS) regression. The problem with analyzing count data in this way is that, because such data are comprised of non-negative integers, they typically form a positively skewed heteroskedastic distribution (Coxe et al., 2009; Walters, 2007). Given this non-normal distribution, the three fundamental assumptions of OLS are violated which can introduce discrepancies between the stated and actual Type I error rates and/or reduce statistical power (Coxe et al., 2009).

As an alternative to the OLS approach, Poisson-class regression models, utilizing a Poisson distribution, may represent a more appropriate approach for examining count data. Poisson regression can be defined by only nonnegative discrete values, uses a log transformation that adjusts for the skewness of the data, and estimates with maximum

likelihood (Gardner, Mulvey, & Shaw, 1995; Walters, 2007). However, as with OLS, Poisson regression also has its own set of assumptions that must be satisfied to be applied appropriately. The application of Poisson regression is limited by the assumptions of population homogeneity (i.e., that changes in the outcome variable are completely accounted for by the predictors included in the model) and equidispersion (i.e., that the conditional mean is equal to the conditional variance). These assumptions limit the use of Poisson regression in situations where the data are characterized by unobserved population heterogeneity (i.e., the difference between individual outcomes is not completely accounted for by the predictors), and overdispersion (i.e., when the conditional variance is greater than the conditional mean). In situations of population heterogeneity and overdispersion, Poisson regression will underestimate the regression coefficient standard errors and thereby inflate the Type I error rate (Coxe et al., 2009; Gardner et al., 1995).

Negative binomial regression falls within the class of Poisson distributions and possesses similar strengths but fewer restrictions. Negative binomial regression includes an error term to allow for unobserved heterogeneity, and a dispersion parameter (α) to allow for a larger conditional variance than is expected in a Poisson regression (Hutchinson & Holtman, 2005; Walters, 2007). If the data are equidispersed (i.e., when $\alpha = 0$), a negative binomial and Poisson regression produce identical results and the Poisson is preferred because is produces a more parsimonious model. However, if the data are overdispersed (i.e., when $\alpha > 0$), a negative binomial regression is preferred because it produces more robust standard errors (Coxe et al., 2009; Long, 1997; Sturman, 1999). An estimate of the dispersion parameter can be calculated through Stata which

indicates whether a Poisson or negative binomial model is more appropriate. This statistic indicated that a negative binomial model was most appropriate for the present data (all *p*s < .001).

An additional concern when examining life event data is the possibility of excessive zero counts. Zero-inflated models for Poisson and negative binomial regression allow for an excessive number of observed zeros (Coxe et al., 2009; Ridout, Demétrio, & Hinde, 1998; Ridout, Hinde, & Demétrio, 2001). In the current sample, a high proportion of participants reported that they experienced no independent life events (see Table 1 for frequency of life event counts); however, it was difficult to ascertain whether this number of zeros was 'excessive' for the purposes of the analyses. Consequentially a zero-inflated negative binomial regression was conducted to test whether this index provided a better fit than the standard model.

The Vuong test, a product of the zero-inflated negative binomial regression, compares the zero-inflated model to the standard model to determine which model is a better fit for the data (Long, 1997). The z-values in each interpretive bias model were not significant when the predicted outcome involved the frequency of independent or dependent life events (all *p*s > .05) indicating that the zero-inflated negative binomial regression was not a better fit than the standard negative binomial regression. As such, a standard model of negative binomial regression was determined to be most appropriate for the present analyses.

Appendix I

Preliminary Analyses Examining Relations Between Demographic Characteristics and Study Variables

Current Depressive Symptom Severity

There was no significant association between participant self-reported age and Time 1 BDI-II scores, $r(206) = -.10$, $p = .16$, or Time 2 BDI-II scores, $r(206) = -.08$, $p = .26$. There was no significant differences among self-reported ethnicity and Time 1 BDI-II score, $F(5, 201) = 0.77$, $p = .58$, or Time 2 BDI-II scores, $F(5, 201) = 0.97$, $p = .44$. Marital status also did not vary significantly with Time 1 BDI-II scores, $F(2, 204) = 2.28$, $p = .11$, or Time 2 BDI-II scores, $F(2, 204) = 0.34$, $p = .72$.

Surprisingly, current depressive symptoms did not vary as a function of self-reported history of a diagnosis for a mental disorder. Participants who reported that they had a history of mental disorder had similar Time 1 BDI-II scores, $t(9.35) = 1.23$, $p = 0.23$, as those without such a history. In contrast, Time 2 BDI-II scores did vary as a function of self-reported history of a diagnosis for a mental disorder. Participants who reported that they had received a previous diagnosis had higher Time 2 BDI-II scores ($M = 19.00$, $SD = 14.59$) than those without such a history ($M = 12.37$, $SD = 9.61$), $t(205) = 2.07$, $p = .04$.

As would be expected given the pattern of results based on self-reported diagnosis history, individuals who had used medication did not differ from those without a medication history on Time 1 BDI-II scores, $t(16.16) = 1.91$, $p = .07$. Individuals who reported receiving medication for an emotional or psychological problem did, however,

report higher Time 2 BDI-II scores (M = 19.37, SD = 13.18) than did those without a medication history (M = 12.13, SD = 9.48), $t(205) = 2.84$, $p = .005$.

Individuals receiving therapy or counselling for an emotional or psychological problem had higher Time 1 BDI-II scores (M = 16.56, SD = 11.58) than did those without a therapy history (M = 11.99, SD = 7.81), $t(46.34) = 2.34$, $p = .02$.These individuals also had higher Time 2 BDI-II scores (M = 17.44, SD = 13.61) than those without a therapy history (M = 11.59, SD = 8.59), $t(45.27) = 2.57$, $p = .01$.

Depression Symptom History

Age was not significantly related to Time 1 IDD-L scores, $r(206) = -.01$, $p = .95$. There was no significant differences between Time 1 IDD-L scores and ethnicity, $H(5) = 10.36$, $p = .07$, or marital status, $F(2, 204) = 0.13$, $p = .88$.

Participants who reported that they did have a history of a diagnosis had higher Time 1 IDD-L scores (M = 32.00, SD = 17.24) than those without such a history (M = 12.79, SD = 15.99), $t(205) = 3.69$, $p < .001$. Individuals who reported receiving medication for an emotional or psychological problem also reported higher Time 1 IDD-L scores (M = 32.44, SD = 19.56) than did those without a medication history (M = 12.15, SD = 15.30), $t(205) = 4.98$, $p < .001$. Individuals receiving therapy or counselling for an emotional or psychological problem had higher Time 1 IDD-L scores (M = 28.08, SD = 21.07) than those without a therapy history (M = 10.38, SD = 13.29), $t(45.26) = 5.02$, $p < .001$.

Interpretive Bias – SST

Participant's self-report age was significantly related to the negativity ratio on the no-load condition, $r(206) = -.14$, $p = .04$. There was, however, no significant association

between age and the negativity, $r(179) = -.07$, $p = .33$, ratio on the cognitive load condition. Ethnicity was not significantly related to the negativity ratio in the cognitive load condition $H(5) = 9.58$, $p = 0.09$. In contrast, ethnicity was related to the negativity ratio for the no-load condition, $H(5) = 11.14$, $p = 0.049$. Marital status was related to the negativity ratio for the no-load condition, $H(2) = 6.70$, $p = 0.04$. Marital status was not related to the negativity ratio in the cognitive load condition, $F(2, 177) = 1.28$, $p = 0.28$.

Similarly, there were no significant differences in the negativity ratios for the no-load or cognitive load conditions based on participants' self-reported medication history (*p*s ranging from .19 to .44) or therapy/counselling history (*p*s ranging from .10 to .97). Negativity ratios on the no-load and cognitive load conditions did, however, differ as a function of the participants' self-reported diagnostic history. More specifically, individuals who reported a history of a diagnosis for a mental disorder tended to have higher negativity ratios in the no-load condition ($M = 0.39$, $SD = 0.25$) than those who did not report a history of a diagnosis of a mental disorder ($M = 0.22$, $SD = 0.21$), $t(205) = 2.34$, $p = .02$. For the cognitive load condition, the same pattern of results was observed. Participants who reported a history of a diagnosis for a mental disorder tended to have higher negativity ratios ($M = 0.42$, $SD = 0.25$) than those without such a history ($M = 0.23$, $SD = 0.23$), $t(178) = 2.48$, $p = 0.01$.

Interpretive Bias – AST

There was no significant association between age and average reaction time for positive target trials, $r(183) = .05$, $p = .47$, or negative target trials, $r(183) = .01$, $p = .92$. Similarly, reaction time for positive target trials ($F[2, 181] = 0.68$, p = .51) and negative target trials ($F[2, 181] = 1.04$, p = .36) did not vary as a function of participants' marital

status. Participants ethnicity was also not associated with reaction time performance on the positive (F[5, 178] = 1.45, p = .21) or negative (F5, 178] = 1.67, p = .14) target trials. As well, there were no significant differences in positive or negative target trials for diagnostic history (ps = .36 to .95), medication history (ps = .23 to .27), or therapy history (ps = .82 to .98).

Stressful Life Events

There was no significant association between any of the life event totals (overall, dependent, independent) and age (ps = .60 to .86), marital status (ps = .55 to .93), or ethnicity (ps = .67 to .85). In addition, there was no differences in life event totals depending on participants' diagnostic history (ps = .65 to .86), medication history (ps = .71 to .99), or therapy history (ps = .88 to .96).

Covariates for Main Data Analyses

To minimize the number of covariates required in subsequent analyses, preliminary tests to ascertain the most 'potent' or necessary variables were conducted. This was done to minimize the potential for residual confounding due to mismeasurement (Christenfeld et al., 2004) and to provide stronger justification for the potential inclusion of covariates, should their inclusion influence the results of the main statistical analyses (Simmons, Nelson, & Simonsohn, 2011).

The main function of Time 1 IDD-L scores in the current study was to serve as a covariate variable in all analyses, to control for a past history of a significant depressive experience. In the case of covariates for Time 1 IDD-L scores, it is not surprising that self-reported history of a diagnosis, self-reported history of medication use for an emotional or psychological problem, and self-reported history of receiving therapy or

counselling for an emotional or psychological problem were all significantly related to worst prior depressive symptom history. All of these self-reported signs point to significant psychological distress at some point in the lives of a sub-set of participants. The inclusion of these additional self-report questions was to ensure that previous psychological distress could be partialled out during statistical analyses. In fact, when entered simultaneously in a linear regression, only therapy history ($\beta = -.24$, $t(203) = -3.18$, $p = .002$) emerges as a significant predictor of IDD-L scores in the context of diagnosis and medication history. Hence, the three variables did not seem to explain a significant amount of variance in IDD-L scores at Time 1.

Similarly, self-reported history of a diagnosis, self-reported history of medication use for an emotional or psychological problem, and self-reported history of receiving therapy or counselling for an emotional or psychological problem were all significantly related to Time 2 depression symptom severity as measured by the BDI-II, and therapy history was also related to Time 1 BDI-II scores. This is again, unsurprising, given that the best predictor of current and future depression, is past psychological distress (e.g., Burcusa & Iacono, 2007; Hammen, Davila, Brown, Ellicott, & Gitlin, 1992). Given that the IDD-L scores was used as a covariate in all analyses, the relationship between self-reported diagnostic, medication, and therapy history were examined in a further set of hierarchical linear regression analyses. In those regressions, IDD-L scores were entered on step one of models predicting Time 1 or Time 2 BDI-II scores, followed by the potential demographic covariate(s) on step two to examine incremental prediction above and beyond IDD-L scores. In both sets of analyses, the demographic self-reported history of psychological distress variables did not predict a significant amount of variance

beyond that predicted by Time 1 IDD-L scores (p = .47 for ΔF in both instances). Hence, it did not appear that these variables contributed additional predictive power over and above that predicted by IDD-L scores alone.

As the earlier described preliminary analyses demonstrated, self-reported diagnosis history was also significant related to negative ratios on the no-load and cognitive load conditions of the SST. Two sets of hierarchical linear regression analyses were conducted to determine if both IDD-L scores *and* diagnostic history were required in the main analyses, or whether IDD-L scores would suffice as the sole covariate subsuming the construct of 'previous psychological distress' relevant to the current study. Separate models were conducted predicting SST no-load and cognitive load scores, respectively. In the first set of analyses, IDD-L scores were entered on step one, followed by self-reported diagnosis history on step two. In these analyses, diagnosis history did not significantly predict variance in SST scores in either the no-load (p = .08) or cognitive load condition (p = .08), above and beyond the significant effect of Time 1 IDD-L (p = .001). In the second set of analyses, the order of entry was reversed, with diagnostic history entered on step one and IDD-L scores entered on step two. In both of these analyses, IDD-L scores explained additional variance to the negativity ratio scores for the no-load (p = .004) and cognitive load (p < .001) conditions on the SST, above and beyond the variance explained by self-reported diagnostic history (p < .05).

Given these results and original purpose of the IDD-L in the current study, IDD-L scores was used as the sole covariate for previous psychological distress in the main study analyses. In any of the main analyses including IDD-L symptom scores as a covariate, self-reported diagnosis, medication, or therapy history were not also included

as covariates. In instances where IDD-L scores were not included (e.g., partial correlations among study variables), the demographic covariates were retained. That is to say that for any analyses where IDD-L scores, Time 1 BDI-II scores, or Time 2 BDI-II scores were the outcome or criterion variable in and of itself (e.g., partials correlations), diagnosis, therapy, and medication history were retained as covariates. Similarly, for any analyses where SST negativity ratios for the no-load or cognitive load conditions were the outcome or criterion variable (e.g., bivariate correlations), diagnosis history was retained as a covariate.

Appendix J

Negative Binomial Models for the Prediction of Life Stress from Relevant Demographic Covariates and Baseline Depression

Before reviewing the results, it is prudent to explain how model fit and gain in prediction were examined (Atkins & Gallop, 2007; Coxe et al., 2009). In Poisson-class regressions, a maximum likelihood procedure is used to estimate the parameters to maximize the log-likelihood, where the log-likelihood is the logarithm of the probability that the observed data came from a population having the estimated parameters. The omnibus test (i.e., $LR\ \chi^2$) compares the log-likelihood of the fitted model (i.e., the model containing the predictors identified by the researcher) to the log-likelihood of the intercept-only model (i.e., the model that contains no predictors). If the $LR\ \chi^2$ is significant, then there is justification to inspect the coefficients for each predictor on an individual basis to determine whether any are significantly different from zero.

The significance of each regression coefficient is tested in the same way as in OLS: (a) the *z* statistic for each predictor variable is calculated by dividing the unstandardized regression coefficient by the standard error of the regression coefficient; and (b) if the absolute value of the *z* statistic is greater than 1.96 (assuming a Type I error rate of .05), then that predictor is identified as a unique predictor of the outcome variable.

Predicted scores in Poisson-class regressions are "linear in the logarithm" (Coxe et al., 2009, p. 124). In other words, when all other variables are held constant, a 1-unit increase in a predictor results in an increase of the natural logarithm of the predicted count that is equal to the value of the unstandardized regression coefficient (*b*). To interpret coefficients in terms of the predictors' effect on the actual count (instead of the

logarithm of the count), the unstandardized coefficient, *b*, must be exponentiated. The exponentiated coefficient, e^b, is then interpretable as an incidence rate ratio (IRR) (i.e., the multiplicative change in the outcome expected with a 1-unit increase in the predictor, holding all other predictors constant; Coxe et al., 2009).

Gain in prediction is tested using the Akaike's information criterion (AIC) and the Bayesian information criterion (BIC). Similar to the *F* test of the ΔR^2 in an OLS regression, AIC and BIC have been proposed as options for comparing alternative non-nested models (Coxe et al., 2009).[16] The AIC and BIC each reflect the fit of the model with a penalty for increasing complexity (i.e., given two models with the same fit, the model with the fewest estimated parameters/the more parsimonious model is preferred). Assuming that two models provide a fit to the same data, the model with the smallest AIC or BIC is preferred. Typically, the AIC and BIC both lead to the selection of the same model (Coxe et al., 2009). In the present study, the comparison of the AIC and BIC across the baseline model (e.g., model with all covariates and baseline control variables) versus the model with the addition of the interpretive bias variables (Table 8) is the crucial one. If a predictor is added to the negative binomial model and the AIC and BIC associated with this new model (e.g., model with an interpretive bias variable) are lower than the AIC or BIC associated with the model that does not include this additional predictor (e.g., model with only covariates and control variables), than the additional predictor is understood to improve prediction of the outcome variable.

[16] The equation for the AIC = -2lnL + 2*k* and the equation for the BIC = -2lnL + *k*ln(*n*), where lnL is the log-likelihood of the current model, *k* is the number of parameters estimated in the model (a parameter is estimated for each predictor, the constant, and alpha), and *n* is the sample size.

Table A

Negative Binomial Models for the Prediction of Life Stress from Relevant Demographic Covariates and Baseline Depression – SST No Load Condition (N = 205)[17, 18]

Model	IRR (95% C.I.)	*Z*	*LR* χ^2	AIC	BIC
Predicted Outcome: Rate ILS			15.31**	647.44	670.70
Age	1.04 (0.98-1.10)	1.19			
Marital Status	0.70 (0.29-1.71)	-0.77			
Ethnicity	1.03 (0.94-1.11)	0.62			
BDI-II – Time 1	1.02 (1.00-1.04)	2.65**			
IDD-L – Time 1	1.00 (1.00-1.01)	1.21			
Predicted Outcome: Rate DLS			24.76***	1149.81	1173.07
Age	0.95 (0.89-1.01)	-1.72			
Marital Status	1.98 (0.97-4.05)	1.88			
Ethnicity	1.06 (0.99-1.13)	1.82			
BDI-II – Time 1	1.02 (1.01-1.04)	3.58***			
IDD-L – Time 1	1.00 (1.00-1.01)	0.52			

Note. The five covariates listed under the predicted outcome were included in the same model (i.e., only two models were estimated). *df* = 7 for *LR* χ^2. *z* = *b/SE*. IRR = incidence rate ratio (i.e., the exponentiated unstandardized regression coefficient, e^b). *LR* = likelihood ratio. AIC = Akaike's information criterion. BIC = Bayesian information criterion. ILS = independent life stress. DLS = dependent life stress. BDI-II = Beck Depression Inventory – II. IDD-L = Inventory to Diagnose Depression, Lifetime Version. *p < .05, **p < .01, ***p < .001

[17] Two participants were excluded from this analysis due to extreme responding on the SLEQ. One participant reported 27 independent events and 88 dependent events and the other reported 33 dependent events, which were both extreme response patterns relative to the values associated with the majority of cases according to Cook's *D*.

[18] The pattern of results was identical in analyses conducted without any demographic covariates included.

Table B

Negative Binomial Models for the Prediction of Life Stress from Relevant Demographic Covariates and Baseline Depression – SST Cognitive Load Condition (N = 178)[19, 20]

Model	IRR (95% C.I.)	*Z*	*LR* χ^2	AIC	BIC
Predicted Outcome: Rate ILS			7.77*	553.25	565.98
BDI-II – Time 1	1.02 (1.00-1.04)	2.05*			
IDD-L – Time 1	1.00 (1.00-1.01)	1.01			
Predicted Outcome: Rate DLS			12.38**	986.82	999.55
BDI-II – Time 1	1.02 (1.01-1.04)	2.88**			
IDD-L – Time 1	1.00 (1.00-1.01)	0.73			

Note. The two covariates listed under the predicted outcome were included in the same model (i.e., only two models were estimated). *df* = 4 for *LR* χ^2. *z* = *b/SE*. IRR = incidence rate ratio (i.e., the exponentiated unstandardized regression coefficient, e^b). *LR* = likelihood ratio. AIC = Akaike's information criterion. BIC = Bayesian information criterion. ILS = independent life stress. DLS = dependent life stress. BDI-II = Beck Depression Inventory – II. IDD-L = Inventory to Diagnose Depression, Lifetime Version.

*$p < .05$; **$p < .01$; ***$p < .001$

[19] Two participants were excluded from this analysis due to extreme responding on the SLEQ. One participant reported 27 independent events and 88 dependent events and the other reported 33 dependent events, which were both extreme response patterns relative to the values associated with the majority of cases according to Cook's *D*.

[20] No demographic covariates were necessary in these analyses, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

Table C

Negative Binomial Models for the Prediction of Life Stress from Relevant Demographic Covariates and Baseline Depression – AST Average Reaction Time for Positive and Negative Target Trials (N = 182) [21,22]

Model	IRR (95% C.I.)	*Z*	*LR* χ^2	AIC	BIC
Predicted Outcome: Rate ILS			10.58**	578.78	591.60
BDI-II – Time 1	1.02 (1.00-1.04)	2.39*			
IDD-L – Time 1	1.01 (1.00-1.01)	1.18			
Predicted Outcome: Rate DLS			15.75***	1023.91	1036.72
BDI-II – Time 1	1.02 (1.01-1.04)	3.45**			
IDD-L – Time 1	1.00 (1.00-1.01)	0.57			

Note. The two covariates listed under the predicted outcome were included in the same model (i.e., only two models were estimated). *df* = 4 for *LR* χ^2. *z* = *b/SE*. IRR = incidence rate ratio (i.e., the exponentiated unstandardized regression coefficient, e^b). *LR* = likelihood ratio. AIC = Akaike's information criterion. BIC = Bayesian information criterion. ILS = independent life stress. DLS = dependent life stress. BDI-II = Beck Depression Inventory – II. IDD-L = Inventory to Diagnose Depression, Lifetime Version.

*p < .05; **p < .01; ***p < .001

[21] Two participants were excluded from this analysis due to extreme responding on the SLEQ. One participant reported 27 independent events and 88 dependent events and the other reported 33 dependent events, which were both extreme response patterns relative to the values associated with the majority of cases according to Cook's *D*.

[22] No demographic covariates were necessary in these analyses, since Time 1 IDD-L scores served as the sole covariate for previous psychological distress. See Appendix L for further details.

CURRICULUM VITAE

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EDUCATION:

2007 – Present **Doctoral Candidate, Clinical Psychology**
The University of Western Ontario, London, Ontario, Canada
Dissertation Title: *Interpretive bias in the context of life stress and depression: An examination of stress generation and diathesis-stress models.*

2007 **Master of Science, Clinical Psychology**
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Master's Thesis Title: *Self-schema organization and reactivity to a negative mood induction procedure.*

2005 **Bachelor of Science (Honours) with Distinction, Psychology**
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Honours Thesis Title: *Differential effects of peer versus parental victimization on the development of adolescent depression as moderated by perceived social support.*

AWARDS, HONOURS, AND DISTINCTIONS:

Academic Awards:

2011 **Beck Institute Scholarship**, *Beck Institute for Cognitive Behavior Therapy*
2011 **Health Professional Student Research Award (HPSRA)** – *Summer 2011 Studentship, Canadian Institute for Health Research (CIHR)*
2011 **Western Graduate Research Scholarship (WGRS**), *The University of Western Ontario*
2010 – 2012 **Research Studentship**, *Ontario Mental Health Foundation (OMHF)*
2010 **Alfred Bader Fellowship in Memory of Jean Royce**, *Queen's University*
2008 **Clinical Section Travel Award**, *Canadian Psychological Association (CPA)*
2007 – 2010 **Canada Graduate Scholarship (CGS)** – *Doctoral Scholarship, Social Sciences and Humanities Research Council of Canada (SSHRC)*
2007 – 2009 **Convention Travel Grant**, *Canadian Psychological Association (CPA)*
2007 **Health Professional Student Research Award (HPSRA)** – *Summer 2007 Studentship, Canadian Institute for Health Research (CIHR)*
2007 **Ontario Graduate Scholarship (OGS)** – *Doctoral (declined)*
2006 **Western Graduate Research Scholarship (WGRS**), *The University of Western Ontario*

Academic Awards Continued:

2006	**Ontario Graduate Scholarship (OGS)** – *Master's*
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2005	**Ontario Graduate Scholarship (OGS)** – *Master's (declined)*
2005	**Ontario-Quebec Exchange Fellowship** *(declined)*
2005	**Graduate Assistantship**, *Ontario Institute for Studies in Education of the University of Toronto (declined)*
2005	**Arts Merit Award**, *University of New Brunswick (declined)*
2005	**Board of Governors Merit Award**, *University of New Brunswick (declined)*
2004	**The Ann Adamson Scholarship in Psychology**, *Queen's University*
2004	**Third-Year Undergraduate Summer Research Assistantship**, *Canadian Language and Literacy Research Network (CLLRnet)*
2004	**Samuel Lunenfeld Summer Student Research Assistantship**, *The Hospital for Sick Children*
2003	**Undergraduate Student Research Award (USRA) in Universities,** *Natural Sciences and Engineering Research Council of Canada (NSERC)*
2001 – 2005	**Dean's Honour List**, *Queen's University*
2000 – 2004	**Queen Elizabeth II Aiming for the Top Tuition Scholarship (QEIIA4T)**, *Ontario Ministry of Training, Colleges and Universities*
2000	**Excellence Award**, *Canada Millennium Scholarship Foundation*
2000	**Future Aces Citizenship Award and Scholarship**, *Herbert H. Carnegie Future Aces Foundation*

Teaching Awards:

2011 – 2012	**Dean's Honor Roll of Teaching Excellence**, *King's University College*
2010 – 2011	**Dean's Honor Roll of Teaching Excellence**, *King's University College*
2007	**Graduate Teaching Assistant Award Nominee** *Society of Graduate Students, The University of Western Ontario*

Service Awards:

2005	**Ontario Volunteer Service Award – 5 Years** *Ontario Honours and Awards Secretariat, Ministry of Citizenship and Immigration, Government of Ontario*
2003	**The Duke of Edinburgh's Award – Gold Award** *The Duke of Edinburgh's Award, Toronto, ON*

PUBLICATIONS:

Dozois, D. J. A., & **Seeds, P. M.** (In press) Psychological assessment and research methods. In D. J. A. Dozois (Ed.). *Abnormal psychology: Perspectives* (5th ed.). Toronto, Ontario: Prentice-Hall.

Covin, R., Dozois, D. J. A., Ogniewicz, A., & **Seeds, P. M.** (2011). Measuring cognitive errors: Initial development of the Cognitive Distortions Scale (CDS). *International Journal of Cognitive Therapy*, *4*, 297-322.

Seeds, P. M., & Dozois, D. J. A. (2010). Prospective evaluations of a cognitive vulnerability-stress model for depression: The interaction of schema self-structures and negative life events. *Journal of Clinical Psychology, 66,* 1307-1323.

Seeds, P. M., Harkness, K. L., & Quilty, L. C. (2010). Peer and parental victimization and adolescent depression: Evidence for the mediating role of perceived social support. *Journal of Clinical Child and Adolescent Psychology*, *39,* 681-692.

Dozois, D. J. A., **Seeds, P. M.**, & Firestone, P. (2010) Psychological assessment and research methods. In D. J. A. Dozois & P. Firestone (Eds.). *Abnormal psychology: Perspectives* (4th ed., pp. 59-89). Toronto, Ontario: Prentice-Hall.

Dozois, D. J. A., **Seeds, P. M.,** Collins, K. A. (2009). Transdiagnostic approaches to the prevention of depression and anxiety. *Journal of Cognitive Psychotherapy, 23*, 44-59.

Hayden, E. P., **Seeds, P. M.**, & Dozois, D. J. A. (2009). Risk and vulnerability in adolescent depression. In C. A. Essau (Ed.), *Treatment of adolescent depression* (pp. 27-56). Oxford, UK: Oxford University Press.

Covin, R. T., Ouimet, A. J., **Seeds, P. M.,** & Dozois, D. A. J. (2008). A meta-analysis of CBT for pathological worry among clients with GAD. *Journal of Anxiety Disorders*, *22*, 108-116.

CONFERENCE SYMPOSIA AND WORKSHOP PRESENTATIONS:

Seeds, P. M., & Dozois, D. J. A. (2011, June). *Interpretation of ambiguous information specifically predicts subsequent depressive symptoms and anxiety symptoms in women.* Paper presented at the 72nd Annual Meeting of the Canadian Psychological Association, Toronto, Ontario, Canada.

Seeds, P. M., Ouimet, A. J., McDermott, R. C., & Mark, L. M. (2011, June). *Cognitive mechanisms in anxiety and depression*. Symposium presented at the 72nd Annual Meeting of the Canadian Psychological Association, Toronto, Ontario, Canada.

Seeds, P. M., Johnson, P. J., & Dozois, D. J. A. (2010, June). *Show me the money: Tips on applying for and obtaining external scholarships and grants.* Workshop presented at the 71st Annual Meeting of the Canadian Psychological Association, Winnipeg, Manitoba, Canada.

Seeds, P. M., Drouin, A., & Dozois, D. J. A. (2009, June). *Making cents of scholarship and grant generation: Tips on applying for and obtaining external funding*. Workshop presented at the 70th Annual Meeting of the Canadian Psychological Association, Montreal, Quebec, Canada.

Johnson, P. J., **Seeds, P. M.**, & Skinner, N. F. (2009, June). *Effective teaching strategies for teaching assistants and new faculty*. Workshop presented at the 70th Annual Meeting of the Canadian Psychological Association, Montreal, Quebec, Canada.

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Johnson, P. J., **Seeds, P. M.,** Smith, K. B., & Dobson, K. S. (2007, June). *A student's guide to applying, and gaining admission, to graduate school in psychology.* Workshop presented at the 68th Annual Meeting of the Canadian Psychological Association, Ottawa, Ontario, Canada.

Seeds, P. (2005, April). *Differential effects of peer versus parental victimization on the development of adolescent depression as moderated by perceived social support*. Paper presented at the 35th Annual Ontario Psychology Undergraduate Thesis Conference, Trent University, Peterborough, Ontario.

POSTER PRESENTATIONS:

Seeds, P. M., Dozois, D. J. A., & Bogler, T. C. (2009, November). *Cognitive reactivity to negative mood states*. Poster presented at the 43rd Annual Convention of the Association for Behavioral and Cognitive Therapies, New York City, USA.

Seeds, P. M., Harkness, K. L., & Quilty, L. C. (2009, June). *Perceptions of peer support following peer and parental victimization: Evidence for mediation of adolescent depression*. Poster presented at the 70th Annual Meeting of the Canadian Psychological Association, Montreal, Quebec, Canada.

Covin, R., **Seeds, P. M.**, Bogler, T. C., Faulkner, B., Ouimet, A. J., & Dozois, D. J. A. (2008, November). *Initial development of the Cognitive Distortions Scale (CDS).* Poster presented at the 42nd Annual Convention of the Association for Behavioral and Cognitive Therapies, Orlando, USA.

Bogler, T. C.., **Seeds, P. M.**, & Dozois, D. J. A. (2008, November). *Self-schema organization, congruent stress, and cognitive reactivity.* Poster presented at the 42nd Annual Convention of the Association for Behavioral and Cognitive Therapies, Orlando, USA.

Seeds, P. M., & Dozois, D. J. A., (2008, June). *The interaction of cognitive structure and stressful life events in the prediction of depressive symptoms.* Poster presented at the 6th International Congress of Cognitive Psychotherapy, Rome, Italy.

Seeds, P. M., & Dozois, D. J. A. (2008, June). O*rganization of self and reactivity to a negative mood challenge.* Poster presented at the 6th International Congress of Cognitive Psychotherapy, Rome, Italy.

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Seeds, P. M., & Dozois, D. J. A. (2008, June). *The structure and content of the self-schema interacts with stressful life events to predict depressive symptoms at one year follow-up.* Poster presented at the 69th Annual Meeting of the Canadian Psychological Association, Halifax, Nova Scotia, Canada.

Seeds, P. M., Dozois, D. J. A., & Wagner, A. C. (2007, June). *The specificity of cognitive organization to depressive symptoms.* Poster presented at the 68th Annual Meeting of the Canadian Psychological Association, Ottawa, Ontario, Canada.

Wagner, A. C., **Seeds, P. M**., & Dozois, D. J. A. (2007, June). *Organization and valence of self-referent attributes and their relationship to early maladaptive schemas.* Poster presented at the 68th Annual Meeting of the Canadian Psychological Association, Ottawa, Ontario, Canada.

Seeds, P. M., Schurter, M., Arnell, K. M., Joannise, M. F., Barr, C. L., Klein, R. M., & Tannock, R. (2007, May). *Rapid Serial Naming across the lifespan: Gender and age effects.* Poster presented at the 19th Annual Convention of the Association for Psychological Science, Washington, DC, USA.

Covin, R. T., Ouimet, A. J., **Seeds, P. M.**, & Dozois, D. A. J. (2006, November). *A meta-analysis on CBT for pathological worry among GAD clients: Preliminary findings*. Poster presented at the 40th Annual Convention of the Association for Behavioral and Cognitive Therapies, Chicago, IL, USA.

Seeds, P. M. (2004, July). Relations among Rapid Automatized Naming (RAN) of digits and colours, RAN cognitive subcomponent processes, and reading-related skills. In J. Brill (Chair), *The Samuel Lunenfeld Research Summer Student Program.* Symposium conducted by The Research Institute, The Hospital for Sick Children, Toronto, Canada.

TEACHING EXPERIENCE:

Sept. 2011 – Dec. 2011	**Instructor** for PSYC 2301a: Introduction to Clinical Psychology, *King's University College*
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Sept. 2006 – Dec. 2006 Jan. 2007 – Apr. 2007	**Teaching Assistant** for PSYC 364F: Child Psychopathology(Instructors: Dr. Elizabeth Hayden; Dr. Graham Reid), *The University of Western Ontario*
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SUPERVISION EXPERIENCE:

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Sept. 2010 – April 2011	**Co-Supervisor**, Student: Lisa M. Mark Thesis Title: *Maladaptive self-schemas, interpretive bias, and dysphoria.*
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